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Application of Principal Component Analysis in Determining the Factors Influence Turnover Intention of Millennial Generation Employees in Medan City

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ABSTRACT
Human resource management is a critical priority that must be continuously enhanced by corporate managers. Effective human resource management is essential for enabling employees to deliver their optimal performance to the company. Conversely, poorly managed employees experience a decline in work motivation and organizational loyalty, which ultimately triggers turnover intention. According to the Deloitte Global Millennial Survey (2019), approximately 49 percent of millennial employees intend to leave their current jobs within the next two years. This study investigates the key factors influencing turnover intention using Principal Component Analysis (PCA) to help companies retain competent human resources and achieve their strategic objectives. The study population comprises millennial employees in Medan City, with a sample of 350 respondents selected via the Lemeshow (1997) technique. Data analysis followed standard PCA procedures, including the Kaiser-Meyer-Olkin (KMO) measure, Bartlett's Test of Sphericity, correlation matrix examination, factor extraction, and interpretation. The PCA results successfully reduced eight correlating variables into two distinct components: positive internal factors (Job Resources) and work pressure factors (Job Demands).

Keywords: Job Satisfaction, Work Stress, Work Environment, Compensation, Career Development.

I. Introduction

In the contemporary global economy, businesses operate in a highly dynamic, innovative, and rapidly changing environment. To maintain a sustainable competitive advantage, organizations must respond promptly and effectively to both internal and external disruptions. Consequently, securing and retaining competent human resources with appropriate expertise has become paramount. Strategic and effective human resource management is crucial for maximizing employee potential and aligning individual capabilities with corporate objectives. When companies fail to establish a supportive work system, employee motivation and organizational loyalty drop sharply, leading to the emergence of turnover defined as an employee's conscious and deliberate cognitive willingness to leave the organization soon. This phenomenon has become a pervasive challenge globally, particularly among the younger workforces. The Deloitte Global

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Millennial Survey (2019), which surveyed 13,416 millennial employees across 42 countries, including 200 participants from Indonesia, revealed that nearly 49% of millennials plan to resign from their current organizations within the next two years. This alarming statistic underscores a widespread shift in workforce stability. High turnover rates impose substantial financial burdens on organizations, including escalating costs for recruitment, onboarding, and training of new personnel. Therefore, managing the early signs of voluntary resignation is critical to sustaining organizational performance.

Prior literature indicates that turnover intention is an effective predictor of actual turnover behavior and is driven by an array of interconnected variables. Studies have linked turnover intention to work stress (Dwihana et al., 2017) , job satisfaction and work environment (Widayati, 2019) , compensation and career development (Yadewani, 2021) , organizational commitment (Delawati, 2024) , as well as job insecurity and job burnout (Piartini, 2020). For instance, millennials are frequently subjected to excessive workloads or tasks misaligned with their official job descriptions, intensifying workplace psychological pressure and stress. Data from the Mental Health Foundation corroborates this, showing that 27% of millennials experience severe workplace stress. Although numerous studies have examined these factors individually or through traditional linear regression to observe direct effects, there is a critical research gap in how these diverse variables structurally group themselves when experienced simultaneously by millennial employees in a specific urban landscape like Medan City. Traditional statistical methods often struggle to isolate underlying structural dimensions when dealing with many highly correlated variables, leading to multicollinearity issues. This study addresses this gap by implementing Principal Component Analysis (PCA) to reduce and structurally regroup eight predominant variables—work stress, job satisfaction, work environment, compensation, career development, organizational commitment, job insecurity, and job burnout—into core principal components. By identifying these core dimensions, this study provides a more parsimonious framework for organizations to design balanced HR interventions that target root causes rather than isolated symptoms.

II. Literature Review and Hypothesis Development

Turnover intention represents the final stage in the cognitive withdrawal sequence, wherein an employee consciously considers, plans, and intends to leave their current organization (Mobley, 1982). In human resource literature, this psychological phenomenon serves as the most accurate immediate predictor of actual voluntary turnover. High turnover rates among millennial employees are particularly disruptive due to the generation's distinct workplace expectations, which prioritize rapid career progression, meaningful work environments, and work-life balance. When these expectations unmet, organizational commitment degrades, rapidly converting into a cognitive intent to resign. Comprehensive modeling of turnover intention often categorizes its antecedents into two main structural dimensions derived from the Job Demands-Resources (JD-R) model: psychological strains (Job Demands) and motivational factors (Job Resources). Internal psychological strains include work stress and job burnout. Work stress arises from operational pressures and role ambiguity, which, if sustained over prolonged periods, culminates in job burnout—a state of physical and emotional exhaustion that severely diminishes organizational loyalty (Maslach & Jackson, 1981). Furthermore, perceived job insecurity—the perceived threat of job loss or instability—amplifies this strain, triggering defensive withdrawal behaviors.Conversely, motivational factors serve as structural anchors that mitigate turnover behavior. Job satisfaction, derived from an employee's positive appraisal of their work experiences, operates in tandem with a supportive work environment and competitive compensation to foster high organizational commitment (Allen & Meyer, 1990).

Adequate compensation and transparent career development frameworks validate the employee's contribution, fulfilling their psychological contract with the firm. When organizations successfully optimize these resources, employees develop affective commitment, significantly reducing their cognitive inclination to seek alternative employment. Principal Component Analysis (PCA) is a robust multivariate statistical technique designed for data reduction and pattern recognition within complex datasets containing numerous correlated variables (Hotelling, 1933). In behavioral and human resource studies, concepts like

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workplace satisfaction or stress are frequently measured through multiple overlapping metrics, which inherently introduces multicollinearity into standard linear models. This multicollinearity distorts structural analysis and inflates standard errors, making it difficult to isolate the true underlying drivers of employee behavior.

PCA addresses this limitation by transforming the original set of correlated variables into a substantially smaller set of uncorrelated variables, designated as principal components. This mathematical transformation is achieved by calculating the eigenvectors and eigenvalues of the data's covariance or correlation matrix. The first principal component (PC1) is mathematically structured to account for the highest possible variance within the original dataset, with each subsequent component (PC2,PC3,PC4) capturing the maximum remaining variance under the orthogonal constraint of being completely uncorrelated with preceding components.By utilizing PCA, this study eliminates redundant variations across the eight behavioral variables (work stress, job satisfaction, work environment, compensation, career development, organizational commitment, job insecurity, and job burnout). This mathematical reduction allows the variables to be condensed into a parsimonious set of core components, thereby providing a clearer, structurally validated framework of the primary dimensions that govern millennial turnover intention in Medan City.

III. Research Method

3.1. Population, Sampling Technique, and Data Collection

The target population for this study comprises millennial generation employees residing and working in Medan City. Since the exact and shifting parameters of the total millennial workforce in this urban area cannot be definitively quantified, the sample size was determined using the formula developed by Lemeshow et al. (1990) for populations of unknown size. Through this calculation, a minimum sample size of 384 respondents is ideally suggested; however, a finalized, highly responsive sample of 350 valid respondents was successfully gathered and utilized for this analysis. The data collection process was carried out across a three-month period from September to November 2025. Primary data collection was executed using a structured online questionnaire distributed via Google Forms. To prevent selection bias, a non-probability purposive sampling method was implemented, targeting active corporate employees born between 1981 and 1996 who currently work within the metropolitan boundaries of Medan.

3.2. Operational Definitions of Variables and Measurement

This study incorporates eight behavioral variables that function as potential structural antecedents to turnover intention. The items for each construct were adapted from established frameworks to ensure operational alignment:

a. Work Stress: Measured through indicators of role ambiguity, excessive workload, and tight deadlines adapted from Afandi (2018).
b. Job Satisfaction: Measured through salary satisfaction, peer relationships, promotion opportunities, and supervisory behavior adapted from Jufrizen & Pratiwi (2021).Work Environment: Measured via physical workplace layout, noise control, and social climate adapted from Sembiring (2020).
c. Compensation: Evaluated through base pay, performance bonuses, and non-financial rewards adapted from Halimah & Faris (2023).
d. Career Development: Assessed through continuous competency progression, training availability, and transparent career planning adapted from Suparyanto (2019).
e. Organizational Commitment: Evaluated using affective, normative, and continuance commitment metrics adapted from Delawati (2024).

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f. Job Insecurity: Assessed via structural internal organizational changes, career path ambiguity, and contract status volatility adapted from Nur Laily (2019).
g. Job Burnout: Measured via dimensions of physical, emotional, and mental exhaustion adapted from Watuseke (2019).

All items were measured on a uniform 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This measurement approach provides sufficient granularity for capturing behavioral variance in multivariate analysis.

3.3. Statistical Analysis

Data analysis was structurally processed using Statistical Package for the Social Sciences (SPSS) software. The analytical sequence proceeded as follows:

a. Instrument Quality Testing: Initial scale integrity was confirmed through internal consistency reliability (Cronbach's Alpha> 0.60) and construct validity tests (Pearson's Correlation Coefficient rhitung >rtabel).
b. Data Suitability Testing: The data structure's compatibility for dimension reduction was validated using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (threshold > 0.50) and Bartlett's Test of Sphericity (significance level $p < 0.05$).
c. Principal Component Analysis (PCA): Factor extraction was performed via PCA. The optimal number of principal components was determined based on the Kaiser criterion (eigenvalues>1.0) and cumulative variance explained. To maximize factor loading distinctiveness and eliminate cross-loadings, orthogonal Varimax rotation was applied.

IV. Result and Discussion

4.1. Instrument Validity and Reliability Analysis

Prior to conducting the dimension reduction procedures, the research instrument was thoroughly assessed to ensure both construct validity and internal consistency. Construct validity was examined by comparing the Pearson product-moment correlation coefficient (r_{count})with the critical value of the correlation table (r_{table})at a significance level of $\alpha = 0.05$. The results showed that all observed behavioral indicators—covering work stress, job satisfaction, work environment, compensation, career development, organizational commitment, job insecurity, and job burnout—had r_{count}values greater than the r_{table}value of 0.104. Therefore, all questionnaire items were considered valid and were retained for subsequent multivariate analysis. Furthermore, the reliability of the instrument was evaluated using Cronbach's Alpha coefficient for each behavioral construct. A measurement scale is generally regarded as reliable when its Cronbach's Alpha value exceeds 0.60, indicating adequate internal consistency and stability. The statistical results revealed that all eight variables surpassed this minimum threshold. Accordingly, the research instrument demonstrated sufficient reliability, confirming that the data were appropriate for further analysis using factor analysis.

4.2. Data Suitability and Factorability Assessment

To confirm whether the distribution of the primary data was mathematically eligible for Principal Component Analysis (PCA), the dataset was evaluated using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The KMO framework measures sampling adequacy, requiring a coefficient greater than 0.50 to justify factorability. Concurrently, Bartlett's Test examines the null

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hypothesis that the original correlation matrix is an identity matrix, which would indicate that the variables are completely uncorrelated.

Table 1. KMO and Bartlett's Test of Sphericity Results

Measure / Test	Statistical Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.855
Bartlett's Test of Sphericity: Approx. Chi-Square	2108.756
Bartlett's Test of Sphericity: Degree of Freedom (df)	36
Bartlett's Test of Sphericity: Significance (p-value)	0.000

As displayed in Table 1, the KMO sampling adequacy index reached 0.855, which significantly exceeds the minimum required threshold of 0.50. Furthermore, Bartlett's Test of Sphericity yielded an approximate Chi-Square value of 2108.756 with a significance value (p-value) of 0.000 ($p < 0.05$). This highly significant result rejects the identity matrix hypothesis, confirming that strong, statistically meaningful correlations exist among the selected variables. To verify that each individual variable was eligible for data reduction, the Anti-Image Correlation matrix was evaluated. The diagonal elements of the Anti-Image matrix present the individual Measures of Sampling Adequacy (MSA) for each variable, where values below 0.50 warrant variable exclusion.

Table 2 Anti-Image Correlation Diagonal Measures of Sampling Adequacy (MSA)

No.	Variable	MSA Value	Status
1	Work Stress	0.866a	Eligible
2	Job Satisfaction	0.891a	
3	Work Environment	0.897a	
4	Compensation	0.898a	
5	Career Development	0.854a	
6	Organizational Commitment	0.828a	
7	Job Insecurity	0.858a	
8	Job Burnout	0.822a	

The statistical values presented in Table 2 demonstrate that every single behavioral variable achieved an individual MSA value well above the 0.50 baseline, spanning from 0.822 to 0.898. This verifies that no individual variable introduces mathematical distortion into the reduction model, thereby satisfying all prerequisite assumptions for multivariate factoring.

4.3. Communalities and Variance Explanation

Communality estimates describe the proportion of variance in each original variable that can be explained by the extracted principal components. An extraction value greater than 0.50 indicates that the extracted underlying components adequately retain the variance of that specific variable.

Table 3. Variable Communalities Estimates via PCA

Variable	Initial Variance	Extraction Variance
Work Stress	1.000	0.766
Job Satisfaction	1.000	0.692
Work Environment	1.000	0.670
Compensation	1.000	0.724
Career Development	1.000	0.749
Organizational Commitment	1.000	0.790
Job Insecurity	1.000	0.786
Job Burnout	1.000	0.811

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As outlined in Table 3, the extraction values range from 0.670 (Work Environment) to 0.811 (Job Burnout). Because all values comfortably surpass the 0.50 benchmark, it is verified that the PCA framework successfully preserves the essential behavioral data without any meaningful loss of information.The optimal number of principal components to extract was governed by the Kaiser criterion, which dictates that only components with an initial eigenvalue greater than 1.0 should be retained.

Table 4. Total Variance Explained by Extracted Principal Components

Component	Initial Total Eigenvalue	Initial % of Variance	Initial Cumulative %	Extraction Total Eigenvalue	Extraction % of Variance	Extraction Cumulative %	Rotated Total Eigenvalue	Rotated % of Variance	Rotated Cumulative %
1	3.696	41.068	41.068	3.696	41.068	41.068	3.660	40.668	40.668
2	3.141	34.896	75.964	3.141	34.896	75.964	3.177	35.296	75.964
3	0.467	5.193	81.157						
4	0.398	4.422	85.579						
5	0.338	3.755	89.334						
6	0.293	3.256	92.590						
7	0.284	3.152	95.742						
8	0.201	2.231	97.973						

Table 4 reveals that out of the eight initial components, only Component 1 and Component 2 exhibit eigenvalues exceeding the 1.0 threshold. Component 1 registers an initial eigenvalue of 3.696, accounting for 41.068% of the total variance. Component 2 presents an initial eigenvalue of 3.141, capturing 34.896% of the remaining variance. Combined, these two extracted principal components explain a cumulative variance of 75.964%. In behavioral science and organizational psychology, a cumulative explained variance exceeding 60% is widely recognized as a highly robust model, confirming that these two dimensions are sufficient to explain the variance in millennial turnover intention.

4.4. Factor Rotation and Orthogonal Cluster Identification

To minimize ambiguity and establish a clear structure where each variable loads heavily onto only one component, orthogonal Varimax rotation was executed. This rotation shifts the factor axes to maximize the variance of the squared loadings, optimizing data interpretation.

Table 5. Rotated Component Matrix Analysis

Variable	Component 1 Loading	Component 2 Loading	Primary Cluster
Work Stress	0.010	0.875	Component 2
Job Satisfaction	0.832	-0.017	Component 1
Work Environment	0.807	0.135	Component 1
Compensation	0.851	0.018	Component 1
Career Development	0.856	-0.126	Component 1
Organizational Commitment	0.885	-0.083	Component 1
Job Insecurity	-0.034	0.886	Component 2
Job Burnout	0.169	0.884	Component 2

The rotated matrix in Table 5 shows an exceptionally clean structural separation: 1. Component 1 Cluster: Job Satisfaction (0.832) , Work Environment (0.807) , Compensation (0.851) , Career Development (0.856) , and Organizational Commitment (0.885) cluster strongly together on the first dimension. This grouping is labeled Job Resources. 2. Component 2 Cluster: Work Stress (0.875) , Job Insecurity (0.886) , and Job Burnout (0.884) load heavily on the second dimension. This structural grouping is designated as Job Demands.

4.5. Critical Discussion and Comparative Analysis

The mathematical extraction of two distinct structural components validates the application of the Job Demands-Resources (JD-R) model within the millennial workforce context in Medan City. By isolating

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these variables into two orthogonal components, the results demonstrate that turnover intention among millennials is not driven by random isolated factors, but rather by a systemic interplay between positive support mechanisms (Job Resources) and psychological strains (Job Demands). Component 1 (Job Resources) combines job satisfaction, work environment, compensation, career development, and organizational commitment. This indicates that for millennial employees, financial rewards alone are insufficient to secure organizational loyalty. Instead, compensation must be bundled with transparent career growth opportunities and a supportive physical and social workplace environment. This finding aligns with the theoretical framework of Malak and Nugraha (2012), who stated that job resources function as critical anchors that mitigate psychological strain, satisfy individual growth needs, and help fulfill organizational goals. Furthermore, this structural alignment provides empirical clarity to previous linear studies. For instance, while Widayati (2019) and Yadewani (2021) observed the isolated direct impacts of satisfaction and compensation respectively , our PCA model demonstrates that these variables function collectively as an integrated internal resource system within the employee's psychological framework.

Component 2 (Job Demands) aggregates work stress, job insecurity, and job burnout into a single high-impact dimension. The high factor loadings for job insecurity (0.886) and job burnout (0.884) reflect that millennials are highly sensitive to corporate stability and continuous cognitive pressure. According to Halim (2023) and Anggreani (2021), job demands encompass operational, physical, and organizational aspects that require sustained cognitive and physical effort. When these demands remain unmitigated, they trigger severe energy depletion and chronic psychological strain. This structural clustering deepens the findings of Dwihana et al. (2017) and Piartini (2020). Rather than viewing stress and insecurity as independent operational issues , this study shows that they combine to form a singular work-pressure dimension that accelerates job burnout, ultimately pushing millennial employees to leave the organization.

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