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OPTIMIZING SOFTWARE ENGINEERING CAREERS: HIRING, RETENTION, AND WORKFORCE DEVELOPMENT

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INTRODUCTION

The high turnover rate among software engineers has become a crucial challenge in the technology industry. No wonder it has been affecting productivity of the companies along with project continuity and overall workforce stability. Research indicates that the software engineering sector goes through some of the highest attrition rates compared to other professions. Factors such as job dissatisfaction, lack of career progression, inadequate compensation and adverse workplace culture remain the major causes (McKinsey & Co., 2023). Although the demand for software engineers remains high, retaining skilled talent has become immensely difficult. It has eventually led to disruptions in product development and financial losses for organizations.

One of the primary reasons for this challenge is the lack of calibration between hiring practices and long-term employee engagement. Many organizations tend to adopt immediate recruitment practices. However, they forget to consider how onboarding, professional development and workplace culture impact long-term retention (Saks & Gruman, 2018). A lack of structured onboarding programs and insufficient career development opportunities has been linked to early-stage attrition among new hires (Bauer et al., 2007; Perrot et al., 2014; Saks et al., 2007; Saks & Gruman, 2021). Furthermore, insufficient leadership and poor

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organizational management are highly responsible for job dissatisfaction. It leads many engineers to seek better opportunities somewhere else (Deloitte, 2021).

Compensation schemes also play a significant role in employee retention. Engineers who consider their salaries and benefits inequivalent to industry standards are more likely to leave their jobs (C. Liu et al., 2022; Y. Liu et al., 2024; Glassdoor Economic Research, 2021). Whereas salary is an important aspect, research data shows that workplace culture including flexible work arrangements and career growth opportunities also largely matter. They can intensely influence an engineer's decision to stay or leave a company ((Azar et al., 2018; Schäfer et al., 2023); Ng et al., 2005). Companies that fail to address these concerns often face continuous employee turnover eventually affecting workforce stability in the long run.

This research is targeted to discover the underlying causes of high turnover in software engineering work positions and propose implementable methods for organizations to improve hiring, onboarding and retention processes. As we take a look at the survey 2022 data and industry trends, we can conclude that this study will provide an extensive framework for upgrading software engineering careers through effective human resource strategies. We ought to address these challenges for building a stable, motivated and high-performing engineering workforce. Driving innovation and business success also remain a major concern.

Contribution of Software Engineering in Today's Digital Economy

Software engineering has undoubtedly become a basic aspect of the modern digital economy. It has been successfully driving technological innovation, business growth, and economic development. Businesses are largely shifting towards digital platforms, cloud computing, artificial intelligence and automation. Consequently, the demand for software engineers is on the rise (McKinsey & Co., 2023). Software engineers in fact do a lot beyond working in just traditional IT services. They are also influencing industries such as finance, healthcare, retail and manufacturing. The credit should go to the growth of enterprise software, mobile applications and cybersecurity solutions. (LinkedIn Workforce Report, 2024).

The World Economic Forum (2023) reports that software development is among the top ten most in-demand skills globally, driven by the rapid adoption of digital technologies. Software engineers play a crucial role in problem-solving and innovation. Combined with technological advancement they're making it essential to businesses competing in the digital marketplace to emphasize them. In particular, emerging technologies such as artificial intelligence, blockchain, and cloud computing are making it really important for specialized engineering talent to be maintained. Fortunately, they also play a role in expanding digital infrastructure (McKinsey & Co., 2023).

Increasing Demand for Software Engineers Globally

Lately the demand for software engineers has been excessively high and thus it outran the supply of skilled professionals. The U.S. Bureau of Labor Statistics (2023) states that employment in software development will grow by 25% from 2022 to 2032, significantly faster than the average growth rate for all occupations. This trend is reflected in other regions as well. Apparently European and Asian technology hubs are experiencing similar scarcity in expertise. According to Korn Ferry's Global Talent Crunch Report (2022), by 2030, the global shortage of software engineers could reach 4.3 million professionals which may lead to $449 billion in unrealized annual revenues for technology firms.

Companies are diligently competing for skilled engineers by offering alluring remuneration together with distance work opportunities and career development schemes. However, attractive employment prospects cannot quite convince the retaining rate of software engineers. Organizations appear to struggle mainly due to the dynamic and competitive nature of the industry (Deloitte, 2021). The shortage of software engineers is

exacerbated by the evolving skill requirements, where businesses seek expertise in advanced programming languages, data science, cybersecurity, and cloud infrastructure, further intensifying the recruitment and retention challenge (Abdolmaleki et al., 2024; Kerdngern & Thanitbenjasith, 2017; Laschinger & Fida, 2014).

Challenges of High Employee Turnover in the Technology Industry

The growing demand for software engineers couldn't defeat the challenges that the technology industry continuously faces in retaining skilled talent. Employee turnover rates in the tech sector are among the highest across all industries. According to the LinkedIn Workforce Report (2024), the average annual attenuation rate for software engineers stands at 13.2%, significantly higher than the 9% industry average across other professions.

The high turnover rate among software engineers may arise due to multiple factors, including:

1. Career Stagnation – Engineers are likely to leave companies due to limited opportunities of career growth (McKinsey & Co., 2023).
2. Workplace Culture – Toxic work environments, poor leadership and lack of recognition contribute to job dissatisfaction (Deloitte, 2021).
3. Compensation and Benefits – Engineers frequently change jobs for higher salaries, better benefits, and stock options (Glassdoor Economic Research, 2021).
4. Work-Life Balance Issues – Excessive workloads, long hours, and burnout are common reasons for attrition in the tech industry (Azar et al., 2018; Schäfer et al., 2023).
5. Recruitment of Specialized Talent – Companies often illegally hire software engineers with niche skills. As a result a competitive job market with frequent job-hopping gets created (Abdolmaleki et al., 2024; Kerdngern & Thanitbenjasith, 2017; Laschinger & Fida, 2014).

High turnover hampers project timelines with increasing hiring costs and affects organizational productivity. A study by the Society for Human Resource Management (SHRM, 2022) interprets that replacing a highly skilled software engineer costs companies 1.5 to 2 times the employee's annual salary due to recruitment expenses, onboarding efforts and diminished productivity. Furthermore, frequent turnover results in the loss of institutional knowledge. It in turn negatively impacts innovation and long-term business success (Dorta-Afonso et al., 2023; Griffeth, 2000; Han, 2022; Li et al., 2023; Tsui et al., 2007).

A strategic approach is required for handling software engineering retention. We should focus on structured hiring, professional growth opportunities and competitive compensation. A Positive workplace culture should be fostered unarguably. This study aims to explore these key factors and propose implementable solutions for reducing turnover in the software engineering industry.

Conceptual Framework

The conceptual framework provides an illustration of the organizational and job-related factors that play a role as the key identifiers of employee turnover in the software engineering profession. Established theoretical models such as Herzberg's Two-Factor Theory, Job Embeddedness Theory and Self-Determination Theory are intertwined with the framework. Besides, it signifies the psychological and structural elements that influence employee retention. Herzberg's theory points out the differences between hygiene factors (e.g., salary, policies) and motivators (e.g., recognition, growth). Additionally, it draws attention to the fact that both must be addressed to improve job satisfaction and reduce attrition (Herzberg, 1959). It is derived from Job Embeddedness Theory that factors such as fit, links, and sacrifice within

an organization affect an employee's decision to stay or leave (Kolasa et al., 2021; Setthakorn et al., 2024; Soga et al., 2022) (Mitchell et al., 2001). Meanwhile, Self-Determination Theory posits that sustained engagement is upheld when fulfilling intrinsic needs like autonomy, competence and relevance are fulfilled (Deci & Ryan, 2000). It is seen that employees' intentions and decisions related to job continuity depend on workplace conditions, culture and growth opportunities. The previously mentioned models also collectively support this presumption.

Onboarding practices, compensation, career development opportunities, workplace culture, employee engagement and work-life balance known as organizational factors are central to this framework. They also continue to have a direct influence on turnover intentions. Turnover intention, defined as the cognitive process of contemplating job departure, acts as a mediating variable linking job-related experiences to actual turnover outcomes (Dorta-Afonso et al., 2023; Griffeth, 2000; Han, 2022; Li et al., 2023; Tsui et al., 2007). Research has consistently shown that structured onboarding reduces early attrition (Bauer et al., 2007; Perrot et al., 2014; Saks et al., 2007; Saks & Gruman, 2021). Moreover competitive compensation improves retention (Glassdoor Economic Research, 2021) as well as career development increases employee commitment (Ng et al., 2005). Similarly ensuring a healthy workplace culture and flexible work arrangements can create more involvement and lower stress (Deloitte, 2021;). If we can understand and effectively apply these organizational variables, turnover among software engineers will be greatly reduced. It is also critical for developing a stable and high-performing workforce.

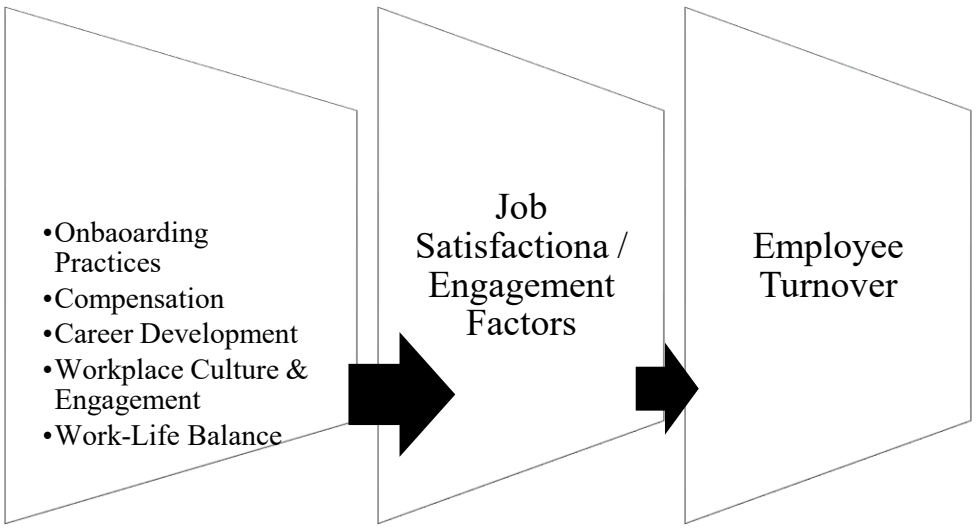

Figure 1: Organizational Factors Affective Employee Turnover

This diagram (Figure 1) shows that engagement factors are organizational factors. They are named as onboarding practices, compensation, career development, workplace culture and work-life balance. Their basic goal is to create job satisfaction. It is represented here how this job satisfaction directly influences employee turnover.

Operational Definitions
Software Engineer

A software engineer is a professional who applies engineering principles to the design, development, testing, and maintenance of software systems and applications. Various industries including technology, finance, healthcare and manufacturing offer employment for software engineers to increase adaptability and build efficient digital solutions (McKinsey & Co., 2023).

Employee Turnover

Employee turnover refers to the rate at which employees leave an organization and are replaced by new hires. Often expressed as a percentage, it includes both voluntary and involuntary separations. High turnover potentially leads to increased recruitment costs combined with loss of institutional knowledge and reduced organizational productivity (Dorta-Afonso et al., 2023; Griffeth, 2000; Han, 2022; Li et al., 2023; Tsui et al., 2007).

Onboarding Practice

Onboarding practices can be termed as structured organizational processes which are designed to integrate new employees into the company. This includes orientation, training, mentoring, and socialization programs that help the newly employed to understand their roles and absorb the company culture. Early engagement and retention are formed as a result (Bauer et al., 2007; Saks & Gruman, 2018).

Workplace Culture

Workplace culture is defined as the set of shared values, beliefs, attitudes, and practices. They all participate in shaping the social and psychological environment of an organization. A positive culture can actively help in flourishing inclusivity, collaboration together with employee well-being. Meanwhile, a toxic culture can contribute to dissatisfaction and attrition (Deloitte, 2021; Edmondson, 2019).

Employee Engagement

Employee engagement denotes the degree to which employees emotionally invest in their work and are committed to the organization. Enthusiasm and effort are found in engaged employees alongside a desire to contribute to organizational goals. It is positively correlated with higher performance and lower turnover (Laschinger & Fida, 2014).

Compensation

Compensation refers to the total financial and non-financial rewards given to employees in exchange for their work. This includes salary, bonuses, stock options, insurance, paid leave, and retirement benefits. Retaining talent is also largely dependent on fair and competitive compensation (Glassdoor Economic Research, 2021).

Career Development Opportunities

Career development opportunities consist of certain programs and pathways that enable employees in enhancing their skills and achieve professional progress aiming to obtain long-term career goals. Training, mentorship, promotions, and leadership development initiatives are included in the strategy (Ng et al., 2005; McKinsey & Co., 2023).

Work-Life Balance

Work-life balance can be expressed as the ability of employees to effectively manage their job responsibilities. Carrying on personal life without experiencing chronic stress or burnout is also a key objective. It includes flexible schedules, remote work, paid time off, and wellness support (Azar et al., 2018; Schäfer et al., 2023).

Employee Turnover Intention

Employee turnover intention is the behavioural strategy by which an employee contemplates leaving their current organization. It is considered a strong indicator of actual turnover. It is further influenced by factors such as job satisfaction, compensation, workplace culture and

growth opportunities (Dorta-Afonso et al., 2023; Griffeth, 2000; Han, 2022; Li et al., 2023; Tsui et al., 2007).

RESEARCH OBJECTIVES

The primary goal of this research is to investigate the factors influencing software engineer turnover. Moreover, it intends to identify strategies to develop workforce stability. Specifically, the study aims to:

1. Compare the employee turnover rates among software engineers based on different onboarding practices (structured, semi-structured, and unstructured).
2. Examine how the types of organization and industry, workplace culture, employee engagement, compensation, career development opportunities, and work-life balance predict employee turnover intentions among software engineers.

LITERATURE REVIEW

The abstract foundation of this study stands on three major theories: Herzberg's Two-Factor Theory, Job Embeddedness Theory, and Self-Determination Theory. Herzberg (1959) distinguishes between hygiene factors (e.g., salary, policy) and motivators (e.g., recognition, growth), It is also argued that both must be addressed to ensure satisfaction and retention. It has been stated by Job Embeddedness Theory that an employee's decision to stay is framed by their connections at work and the recognized sacrifice of leaving (Kolasa et al., 2021; Setthakorn et al., 2024; Soga et al., 2022) (Mitchell et al., 2001). To conclude, Self-Determination Theory (Deci & Ryan, 2000) emphasizes that employees are more likely to remain committed when their needs for autonomy, competence, and relatedness are fulfilled. Combinedly these theories eventually lead to identification and analysis of turnover-related factors.

Understanding Software Engineer Turnover

The technology industry is witnessing an unparalleled surge in demand for software engineers. The global shift toward digitization, artificial intelligence and automation remains as the key factor (McKinsey & Co., 2023). However, despite this demand, companies are actively struggling with rising attrition rates. Software engineers show higher turnover rates than most others in the professional workforce, reportedly at 13.2% compared to the 9% cross-industry average (LinkedIn Workforce Report, 2024). High turnover hampers team dynamics and slows project timelines, additionally escalating hiring and training costs (Dorta-Afonso et al., 2023; Griffeth, 2000; Han, 2022; Li et al., 2023; Tsui et al., 2007). Organizational innovation can also wear out because of dissipated institutional knowledge. Nevertheless, it leaves employee retention a strategic priority in software engineering.

The Role of Onboarding Practices in Retention

Effective onboarding is an essential first step in forming employee expectations and organizational commitment. Research by (Bauer et al., 2007; Perrot et al., 2014; Saks et al., 2007; Saks & Gruman, 2021) highlights that enhancement of job satisfaction as well as reduction in early-stage attrition are caused by structured onboarding—including role-specific training, mentorship, and social integration. Saks and Gruman (2018) argue that onboarding should be seen as a socialization process, enabling new hires to engage deeply with organizational values and practices. On the contrary, poorly implemented onboarding eventually causes job-role confusion, misaligned expectations and rapid exits occur. Comprehensive onboarding is key to early retention in fast-paced environments like tech since projects are complex and team integration is also to be considered vital.

Compensation and Benefits as Predictors of Turnover

Compensation is recognised as one of the most influential external motivators for employee retention. The Glassdoor Economic Research (2021) report finds that inconsistency in salary and benefits contribute significantly to voluntary turnover among software engineers. Trevor et al. (1997) mentions that satisfaction with pay is especially important in performance-driven environments where compensation is considered a standard by employees against industry norms. Along with competitive base pay, benefits like stock options, insurance, and flexible work arrangements often incorporate into job satisfaction (Deloitte, 2021). The failure to offer fair and evolving compensation packages often drives employees to search for better opportunities.

Career Development and Professional Growth

Career stagnation is cited as a prime reason that makes software engineers leave their jobs (McKinsey & Co., 2023). Skills development and mentorship apparently provides clear pathways for career advancement. Hence, they can greatly reduce turnover. Ng et al. (2005) found strong connections between career development opportunities and both objective as well as subjective career success. Furthermore, their absence may ultimately cause disengagement and eventual attrition. Investment in continuous learning programs, certifications, leadership grooming and internal mobility is said to generate higher retention in organizations. As a result, employees feel appreciated and perceive long-term potential within the company.

Workplace Culture and Employee Engagement

A positive workplace culture is outlined by respect, inclusion, and support. Concurrently, it has been frequently linked to lower turnover rates. Deloitte (2021) prioritizes the fact that culture is about both perks as well as leadership, psychological safety and clear communication. In support of that, Edmondson (2019) argues that psychological safety encourages innovation and retention. The ability to express ideas without fear of repercussion do the same in turn. Simultaneously employee engagement represents an estimation of emotional and cognitive investment in work. Laschinger and Fida (2014) demonstrate that disengaged employees are prone to experience burnout and quit regardless of competitive compensation. Culture and engagement are consequently the key strategic levers.

Work-Life Balance and Burnout Prevention

Burnout remains a major challenge in the tech sector for existing tight deadlines, long hours and demanding clients. Azar et al., (2018) found that flexible work arrangements—including remote options and autonomy over schedules—stays appraised even more than compensation by many employees. Wellness programs, mental health days and adequate time off count as work-life balance initiatives and they actively contribute to prevent employee fatigue and emotional exhaustion. Organizations prioritizing work-life harmony tends to reduce attrition as well as increase employee satisfaction coupled with productivity (Glassdoor Economic Research, 2021).

Summary and Research Gap

Considerable evidence in the existing literature suggests that onboarding, compensation, career development, workplace culture and work-life balance are the leading factors in understanding software engineer turnover. However, there is limited empirical work focusing specifically on software engineers in rapidly evolving tech sectors whereas hybrid work, AI integration and global mobility are changing the landscape. This study seeks to fill that gap by offering data-driven strategies customized specially for this workforce.

RESEARCH METHODOLOGY

Research Design

This study employed a quantitative, non-experimental, ex post facto research design to investigate the factors influencing employee turnover intention among software engineers. The ex post facto approach was appropriate because the study examined existing conditions and behaviors. The design allowed for the statistical examination of relationships and predictive patterns between independent variables and the dependent variable (turnover intention) based on participants' self-reported experiences.

Sample and Sampling Procedure

The sample for this study consisted exclusively of full-time software engineers working in various sectors including technology, healthcare, finance, and other software-reliant industries. Participants were drawn from organizations of different sizes, including startups, small and medium-sized enterprises (SMEs), and multinational corporations, to ensure broad representation of the software engineering workforce. A purposive sampling technique was employed, as the study specifically targeted individuals currently engaged in full-time software engineering roles. The survey link was disseminated through the Human Resources (HR) departments of participating organizations, who facilitated contact with eligible employees via email.

Data Collection

Data for this study were collected using an online survey questionnaire distributed via a structured Google Form. The survey was disseminated across four major industry sectors: technology, healthcare, finance, and other relevant software-driven industries. To ensure diverse organizational representation, the survey targeted startups, small and medium-sized enterprises (SMEs), and multinational companies. The distribution process was facilitated through each company's Human Resources (HR) department, which shared the survey link directly with their full-time software engineers via official email channels. Participants were given seven days to complete and submit their responses. At the end of the collection period, all questionnaires were returned, resulting in a 100% response rate from the contacted engineers.

Data Analysis Techniques

The first research question compared the employee turnover rates among software engineers based on different onboarding practices (structured vs. unstructured). To examine differences in employee turnover rates across onboarding practices, a quantitative approach was employed using data collected through a structured questionnaire (see Appendix A, Section II: Onboarding Practices).

The onboarding experience was measured using four 5-point Likert-scale items that assessed role clarity, training adequacy, mentorship, and adaptation to company culture. An average score of the onboarding scale items was computed first. Then, to classify respondents into meaningful onboarding practice categories, the mean scores were divided into two groups: low onboarding (unstructured) and high onboarding (structured). This transformation converted the continuous onboarding variable into a categorical independent variable suitable for comparative analysis.

To compare the mean turnover intention scores between the two groups, an independent samples t-test was conducted. This test assessed whether significant differences existed in turnover intentions between the low onboarding group (unstructured onboarding) and the high onboarding group (structured onboarding).

Before conducting the t-test, assumptions of normality via Levene's test were checked to ensure the validity of the analysis. If the assumptions were met, the t-test results would indicate whether turnover intentions significantly differed between employees with low onboarding and high onboarding experiences.

If the t-test results were statistically significant ($p < .05$), the mean turnover intentions for both groups would be compared to interpret the results.

To address Research Question two, hierarchical multiple regression analysis was conducted to examine the predictive influence of organizational characteristics and HR-related factors on employee turnover intention among software engineers. The analysis was structured in two blocks. Block 1 included categorical variables—type of organization (startup, SME, or multinational) and industry (e.g., tech, finance, healthcare)—which were dummy coded prior to entry. Block 2 incorporated continuous predictors based on the mean scores of validated Likert-scale items: workplace culture, employee engagement, compensation, career development opportunities, and work-life balance. The dependent variable, turnover intention, was also calculated as a mean score, with reverse-coded items adjusted accordingly. Reliability of all multi-item scales was assessed using Cronbach's alpha, with values of $\alpha \geq 0.70$ considered acceptable.

The hierarchical regression analysis was performed in SPSS (Analyze → Regression → Linear), where changes in R^2 and the significance of the F-change were used to evaluate the added explanatory power of HR practices beyond basic organizational variables. Standardized beta coefficients (β) were reported to assess the strength and direction of individual predictors. Prior to interpreting results, assumptions of linearity, independence of errors (Durbin-Watson statistic), homoscedasticity, normality (Q-Q plots and Shapiro-Wilk test), and multicollinearity (Variance Inflation Factor < 5) were examined and met.

RESULTS

Descriptives

The final sample comprised 387 full-time software engineers from various sectors including technology, healthcare, finance, and other software-driven industries. Of the respondents, 386 (99.7%) were male and 1 (0.3%) was female. It indicates that software engineering occupation is a predominantly male workforce. Participants represented a range of professional roles, with 49.1% identifying as Senior Software Engineers, 24.8% as Software Engineers, 22.7% as QA Leads, and 3.4% categorized under other roles.

The majority were employed by small and medium enterprises (SMEs) (47.5%), followed by multinational companies (26.4%), startups (24.3%), and a small portion from other organizational types (1.8%). Industry-wise, 74.2% worked in the technology sector, 24.5% in finance, 0.5% in healthcare, and 0.8% in other industries. The mean age of participants was 37.95 years (SD = 4.52), with a range from 26 to 44 years. In terms of professional experience, respondents had an average of 13.62 years in software engineering roles (SD = 3.05), ranging from 0 to 18 years.

Analysis of the First Research Question using T-Test

The research question was: Do employee turnover intentions differ significantly based on the level of onboarding experience (structured vs. unstructured). Objective was to examine whether structured onboarding practices are associated with lower turnover intentions among software engineers compared to unstructured onboarding. An independent samples t-test was conducted to compare the mean turnover intention scores between two groups: Low Onboarding (unstructured onboarding), High Onboarding (structured onboarding).

The variable of interest was Onboarding Experience, a composite mean score derived from Likert-scale items measuring role clarity, training adequacy, mentorship, and adaptation to company culture.

Table: Group Statistics

Onboarding Category	N	Mean	Std. Deviation	Std. Error Mean
Low Onboarding	202	3.85	0.122	0.00859
High Onboarding	185	4.01	0.082	0.00604

To test Equality of Means, Levene's Test for Equality of Variances was run. It was significant ($F = 21.037$, $p < .001$), indicating unequal variances; therefore, the Welch's t-test results (equal variances not assumed) were interpreted. Whereby $t(354.48) = -14.92$, $p < .001$, Mean difference = -0.157 and 95% CI = [-0.177, -0.136].

The obtained effect size is Cohen's d = -1.49 (large effect) and Glass's delta = -1.91

The results show a statistically significant difference in turnover intentions between the two groups. Participants who experienced structured onboarding ($M = 4.01$) reported lower turnover intentions compared to those who had unstructured onboarding ($M = 3.85$).

The effect size (Cohen's d = -1.49) indicates a large practical significance, suggesting that onboarding practices have a strong influence on whether software engineers are likely to stay with an organization.

The findings support the hypothesis that structured onboarding is associated with reduced turnover intentions. Organizations seeking to retain software engineering talent should invest in robust onboarding programs emphasizing clarity, mentorship, and cultural integration.

Analysis of Second Research Question

The second research question was to what extent do organizational characteristics and HR-related factors predict turnover intention among software engineers. To address this research question, a hierarchical multiple regression analysis was conducted using SPSS. The dependent variable was turnover intention, measured as the mean score of four Likert-scale items (with reverse-coding applied to one item). The analysis was performed in two blocks. Block 1 included two organizational variables: type of organization and industry. Block 2 added five continuous predictors representing HR practices: workplace culture, employee engagement, compensation, career development opportunity, and work-life balance. The model summary is presented below:

Table 1. Model Summary

Model	R	R^2	Adjusted R^2	Std. Error	ΔR^2	F Change	Sig. F Change
1	.059	.004	-.002	.17698	.004	0.678	.508
2	.732	.536	.527	.12163	.532	86.817	.000

In **Model 1**, the organizational variables (OrgType and Industry) explained only **0.4%** of the variance in turnover intention, and this result was not statistically significant ($p = .508$). However, when HR-related factors were added in **Model 2**, the model explained **53.6%** of the variance, representing a large and statistically significant improvement ($p < .001$). This

substantial increase in R^2 ($\Delta R^2 = .532$) suggests that HR practices are highly influential in predicting turnover intentions.
The following table presents the regression coefficients for the full model (Model 2):

Table 2. Coefficients for Predicting Turnover Intention (Model 2)

Predictor	B	Std. Error	Beta (β)	t	Sig.
(Constant)	3.394	0.275	—	12.354	.000
Type of Organization	-0.032	0.013	-0.199	-2.458	.014
Industry	0.002	0.018	0.008	0.091	.928
Workplace Culture	-0.765	0.079	-0.541	-9.638	.000
Employee Engagement	-0.175	0.111	-0.109	-1.576	.116
Compensation	-0.343	0.067	-0.441	-5.143	.000
Career Development Opportunity	-0.016	0.095	-0.015	-0.166	.868
Work-Life Balance	1.461	0.104	1.307	14.034	.000

The analysis showed that workplace culture, compensation, work-life balance, and type of organization were statistically significant predictors of turnover intention. In particular, work-life balance had the strongest predictive power ($\beta = 1.307$, $p < .001$), but interestingly, the direction of the relationship was positive. This result implies that higher perceived work-life balance is associated with higher turnover intention, which may seem counterintuitive. A potential explanation might be that employees with better work-life balance feel more confident and secure in seeking new job opportunities, or that they perceive work-life balance as compensatory in an otherwise dissatisfying job.

Conversely, workplace culture ($\beta = -0.541$, $p < .001$) and compensation ($\beta = -0.441$, $p < .001$) had strong **negative** relationships with turnover intention, indicating that better organizational culture and competitive compensation significantly reduce the likelihood that employees will consider leaving. The type of organization also played a small but significant role ($\beta = -0.199$, $p = .014$), with employees from certain organization types reporting lower turnover intentions.

However, industry, employee engagement, and career development opportunities were not significant predictors in the final model, suggesting that they did not independently explain additional variance in turnover intention after accounting for the other variables.All assumptions for regression analysis were tested and met:

- Linearity and homoscedasticity were confirmed via scatterplots.
- Normality of residuals was acceptable based on the P-P plot.
- Multicollinearity was not a concern, with all **Variance Inflation Factor (VIF)** values below 10 (ranging from 2.57 to 7.08).
- The **Durbin-Watson statistic** was 1.055, slightly below the ideal range (1.5–2.5), but still interpretable.

The results indicate that **organizational-level HR factors** significantly influence software engineers' turnover intentions, more so than basic structural variables like industry or organization type. Most notably, **work-life balance**, **workplace culture**, and **compensation** emerged as the most impactful predictors. These findings suggest that improving internal HR strategies may be key to reducing attrition in the software engineering workforce.

DISCUSSION

The current study explored the factors influencing turnover intention among software engineers by examining both the impact of onboarding experiences and a range of organizational and HR-related predictors. The findings support previous research indicating that structured onboarding and effective human resource practices significantly reduce the likelihood of employee turnover in the technology sector.

The results of the independent samples t-test revealed that software engineers who experienced structured onboarding reported significantly lower turnover intentions than those with unstructured onboarding ($M = 4.01$ vs. $M = 3.85$, $p < .001$). The effect size was large (Cohen's $d = -1.49$), suggesting that early-stage socialization and support play a vital role in shaping employees' commitment to their organizations. This finding aligns with prior studies which emphasized that well-designed onboarding processes improve role clarity and job satisfaction, ultimately reducing early attrition (Bauer et al., 2007; Saks & Gruman, 2018; Saks et al., 2007).

Further, the hierarchical regression analysis demonstrated that HR-related factors explained a substantial proportion of the variance in turnover intention ($\Delta R^2 = .532$, $p < .001$), far exceeding the contribution of structural variables such as organization type and industry. Specifically, workplace culture ($\beta = -0.541$), compensation ($\beta = -0.441$), and work-life balance ($\beta = 1.307$) emerged as significant predictors. These results corroborate existing literature emphasizing the importance of cultural fit, fair compensation, and personal well-being in employee retention (Glassdoor Economic Research, 2021; Deloitte, 2021; Azar et al., 2018).

Interestingly, work-life balance was found to have a positive relationship with turnover intention, which may initially seem counterintuitive. One possible explanation is that employees who achieve work-life balance may feel more empowered or confident to explore external opportunities, especially in a competitive labor market. This unexpected finding suggests a complex relationship where work-life balance alone may not guarantee retention if other motivational factors—such as growth opportunities or workplace innovation—are lacking (Schäfer et al., 2023).

Notably, employee engagement and career development opportunities did not significantly predict turnover intention in the final model. This result may be attributed to either a ceiling effect, where most respondents already rated these factors highly, or contextual variables such as the availability of external job offers and the flexibility of the tech industry that override internal development efforts (Ng et al., 2005).

The implications of these findings are twofold. First, companies must prioritize structured onboarding programs that support social integration and role adaptation to prevent early turnover. Second, ongoing retention efforts should focus on cultivating a healthy organizational culture and offering competitive compensation packages. While work-life balance is often promoted as a retention strategy, its relationship with turnover intention requires interpretation and may benefit from further qualitative inquiry.

CONCLUSION

This study examined the factors contributing to turnover intention among software engineers, with a specific focus on onboarding practices and organizational HR strategies. The results confirmed that structured onboarding significantly lowers turnover intentions. It proves that the critical role of early-stage employee integration in ensuring long-term commitment. Additionally, hierarchical regression revealed that HR-related variables—particularly workplace culture, compensation, and work-life balance—explained a significant proportion of variance in employees' intentions to leave, whereas structural characteristics such as industry and organization type offered limited predictive value.

These findings underscore the importance of investing in not just talent acquisition, but also in long-term engagement and retention strategies. Organizations that prioritize transparent culture, fair compensation, and personalized onboarding processes are better positioned to retain skilled software professionals in a competitive labor market. While the positive association between work-life balance and turnover intention was unexpected, it provides an opportunity to explore deeper motivational dynamics in modern work environments.

FUTURE RESEARCH

While this study contributes valuable insights, several avenues for future research remain open. Future studies could employ qualitative methods, such as interviews or focus groups, to explore the paradoxical finding that higher work-life balance may increase turnover intention. Additionally, as remote and hybrid work models continue to evolve, exploring their effects on job satisfaction and employee retention is also highly relevant. Lastly, integrating mediating and moderating variables—such as organizational commitment, psychological safety, or job embeddedness—may offer a more refined understanding of the mechanisms that influence turnover behavior.

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Appendix A: Questionnaire

Section I: Demographic Information

Please provide answers to the following questions:

1. What is your age?
2. What is your gender?
3. What is your current job title?
4. How many years of experience do you have in software engineering?

5. What type of organization do you work for? (e.g., startup, SME, multinational)
6. Which industry do you primarily work in? (e.g., finance, healthcare, tech)
7. What is your current employment status? (e.g., full-time, part-time, contract)

Section II: Main Questionnaire

Please indicate your level of agreement with the following statements using the 5-point Likert scale:

Scale:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

A. Onboarding Practices for role clarity

1. The onboarding process helped me understand my job role clearly.
2. I received sufficient training during the onboarding period.
3. My onboarding experience included mentorship or guidance.
4. The onboarding process helped me adapt to the company culture.

B. Workplace Culture and mentorship adaptation

5. My workplace promotes inclusivity and diversity.
6. I feel respected and valued by my colleagues.
7. There is open and effective communication in my workplace.
8. My organization supports psychological safety and trust.

C. Employee Engagement

9. I feel emotionally connected to my work.
10. I am enthusiastic about my daily tasks.
11. I am motivated to contribute to my organization’s goals.
12. I rarely feel disengaged at work.

D. Compensation

13. I am satisfied with my base salary.
14. My compensation package is competitive compared to industry standards.
15. I receive adequate bonuses or performance incentives.
16. The non-monetary benefits provided by my organization meet my needs.

E. Career Development Opportunities and training adequacy

17. My organization provides clear career progression opportunities.

18. I have access to professional training and development.
19. Mentorship and guidance are available to support my career growth.
20. I am encouraged to take on leadership or new responsibilities.

F. Work-Life Balance

21. I am able to manage my work and personal life effectively.
22. My organization offers flexible work arrangements.
23. I rarely experience burnout due to workload.
24. I have sufficient time off and wellness support.

G. Employee Turnover Intention

25. I often think about leaving my current job.
26. I am actively looking for new job opportunities.
27. I would leave this job if offered a better opportunity elsewhere.
28. I see myself staying with this organization long-term. *(Reverse-coded)*