Designing Human-Centered Socio-Technical Systems to Mitigate Turnover Intention: Evidence from the Macedonian IT Industry

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Abstract

High employee turnover remains a persistent challenge in the IT sector, particularly in emerging markets like Macedonia's. This study frames turnover intention as a manifestation of socio-technical misalignment where work systems fail to integrate technological structures with human needs. Drawing on socio-technical systems theory and Enid Mumford's ETHICS methodology, we examine how organizational culture and job satisfaction interact to in6luence employees' intentions to leave. Using Structural Equation Modeling (SEM) on survey data from Macedonian IT professionals, we empirically validate the mediating role of job satisfaction between organizational culture and turnover intention. Our 6indings underscore the need for human-centered system design that prioritizes both technical ef6iciency and social well-being. We offer actionable insights for IT organizations aiming to redesign work environments to enhance employee retention.

Keywords

Socio-technical systems, turnover intention, organizational culture, job satisfaction

1. Introduction

High employee turnover is a pressing concern in knowledge-intensive industries such as information technology (IT). Turnover not only results in signicant costs for recruiting and training replacements, but also disrupts ongoing projects, erodes team knowledge, and can dampen morale among remaining sta. This challenge is especially pronounced in smaller IT markets like Macedonia's, where skilled professionals have abundant opportunities to either join multinational companies or work abroad, leading to "brain drain" pressures on local rms. In this context, understanding and mitigating turnover intention, employees' conscious inclination to leave their current job is of paramount importance. Traditional human resource approaches to reducing turnover o%en focus on extrinsic incentives (salary, benets) or reactive measures (counteroers, exit interviews). While these aspects are important, we argue that a deeper, systems-level perspective is needed. This paper frames persistent turnover as a symptom of misalignment in the socio-technical system of an organization's work environment. Socio-technical systems theory posits that every organization comprises both social subsystems (people, culture, roles, processes) and technical subsystems (tools, technologies, formal structures), which must be jointly optimized for the organization to perform eective. Misalignment, for example, highly rigid technical procedures that con)ict with employees' human needs for autonomy or work-life balance can generate employee dissatisfaction and disengagement. In many IT rms, new so%ware, methodologies, or work)ows are introduced with an emphasis on technical e+ciency, but if these changes ignore the human factor, they may inadvertently create stress, reduce job satisfaction, and increase turnover intent. In other words, when information systems and work processes are not designed in a human-centered way, employees may feel like cogs in a machine, leading them to seek more fullling work elsewhere. This paper proceeds as follows. First, we review the theoretical background and related work, drawing on socio-technical systems theory and the ETHICS methodology to formulate our hypotheses. Next, we outline our research methodology, including details of the survey conducted among Macedonian IT professionals and our use of SEM for analysis. We then present the results of the SEM analysis, testing the relationships between culture, satisfaction, and turnover intent. In the discussion, we oer implications for socio-technical design, specically, how principles from Mumford's ETHICS method and human-centered design can be applied by organizations to address the identied issues. Finally, we conclude with re)ections on research and practice, underlining the importance of jointly optimizing technical and social factors to achieve both low turnover and high performance.

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2. Literature Review and Theoretical Framework

2.1.Socio-Technical Systems Theory and the ETHICS Method

Effective management of organizational change and information systems requires balancing technical and human factors. Socio-Technical Systems (STS) theory provides a lens for understanding this balance by treating organizations as composed of interacting social and technical subsystems. The core principle of STS theory is joint optimization where organizational outcomes are maximized when social and technical elements are designed in harmony, rather than one being optimized at the expense of the other In practical terms, introducing new technologies or processes should go hand-in-hand with attention to employees' needs, organizational culture, and job design [8]. A lack of alignment between the social system (e.g. culture, team dynamics, employee skills) and the technical system (e.g. tools, workflows, formal procedures) can lead to unintended outcomes such as user resistance, low morale, or high employee turnover. For instance, a highly efficient technical system that routinizes work without regard to job enrichment may undermine employees' job satisfaction, prompting them to seek more fulfilling positions elsewhere. One influential approach in socio-technical design is Enid Mumford's ETHICS method, which stands for "Effective Technical and Human Implementation of Computer-Based Systems." The ETHICS methodology explicitly integrates human considerations into information systems design and organizational change. Mumford argued that future users of a system (employees at all levels) should actively participate in its design and that, along with technical goals, designers should set explicit objectives for improving job satisfaction and quality of working life [7]. By involving employees in design decisions, organizations can better identify what people need to be satisfied and effective in their jobs. In fact, ETHICS prescribes that socio-technical systems should be built to achieve both high technical performance and high job satisfaction for users [1]. As Mumford [7] put it, a true socio-technical approach "recognises the interaction of technology and people and produces work systems which are both technically efficient and have social characteristics which lead to high job satisfaction." [1]. This ethos was born from observations that many purely technocentric implementations failed. Systems designed with only technical and economic factors in mind often floundered because they ignored human needs and the organizational context [1]. In contrast, ETHICS and related participative methods aim to preempt negative outcomes like de-skilled jobs, stress, or resistance to change by ensuring that changes in technology come with parallel adjustments to jobs, workflows, and other social system elements. In summary, socio-technical theory (and the ETHICS method in particular) suggests that human-centered design is not just a "nice-to-have," but a necessity for sustainable success [1,7,8]. If employees help shape a new system to improve their own work conditions, they are more likely to embrace it, experience higher morale, and stay committed to the organization [1,7,8]. Conversely, if human needs are neglected, even well-intentioned technical innovations can deteriorate the work climate, leading to dissatisfaction and increased turnover This study adopts these principles as a guiding framework: we expect that social-system improvements (like enhancing culture) will translate into measurable improvements in human outcomes (job satisfaction, retention) even as technical work continues.

2.2.Organizational Culture, Job Satisfaction, and Turnover Intention

Within the employee turnover theoretical framework, two constructs are especially pertinent to employee turnover and those are organizational culture and job satisfaction. Organizational culture encompasses the shared values, norms, and practices in a company, essentially, the social environment of work [2]. It influences how employees experience their workplace and thus is closely linked to job satisfaction [4]. Positive, supportive cultures (for example, those fostering open communication, employee involvement in decision-making, recognition of contributions, and a clear mission) tend to produce more satisfied employees and better performance outcomes. For example, organizations that promote teamwork, and a compelling organizational mission are known to attract and retain talent by fulfilling employees' social and esteem needs. Employees in such environments often report higher satisfaction and commitment. In contrast, cultures characterized by mistrust, poor communication, or misaligned values can erode satisfaction and spur turnover. In those cases, even if technical aspects of the job are adequate, the negative cultural atmosphere ("how we do things here") can push employees away. Schein's work on organizational culture underscores that culture operates as a "social glue" [2]. It connects members of the organization and guides their behaviors by shaping shared assumptions. This social glue effect means culture can significantly affect outcomes like morale, job satisfaction, and employees' intention to stay or leave. Empirical research by MacIntosh and Doherty [9] found that a constructive culture (open communication, shared goals) was associated with higher job satisfaction and lower intention to leave among employees [8]. Job satisfaction is a key attitudinal outcome reflecting how content employees are with various aspects of their job including the nature of the work, compensation, growth opportunities, work-life balance, management, and coworkers [10]. High job satisfaction has consistently been associated with lower turnover intention. Satisfied employees are far less likely to be actively thinking about quitting or looking for alternative jobs [3]. Conversely, low satisfaction is a well-established precursor to voluntary turnover. Mobley's model [3] of turnover was a landmark in articulating how dissatisfaction translates into turnover.

Dissatisfied employees begin by thinking about quitting, then evaluating the pros and cons, possibly searching for alternatives, developing an intention to leave, and finally actual turnover if the intention is strong and alternatives are available [4]. Over the years, numerous studies across sectors have echoed the fundamental inverse relationship between satisfaction and turnover intentions. Thus, understanding what drives turnover intention is crucial for intervention, as it provides an opportunity to address issues before an employee actually exits [11]. Based on this theoretical background, we formulated a model (illustrated in Figure 1) in which organizational culture positively influences job satisfaction, and job satisfaction negatively influences turnover intention. In addition, we considered employees' job experience (tenure in years) as a control variable, hypothesizing that more experienced employees might have lower intent to leave. In our model, organizational culture is treated as an exogenous predictor, job satisfaction as a mediator between culture and turnover, and turnover intention as the ultimate outcome (endogenous variable). This mediational structure reflects that culture's effect on turnover is primarily indirect, working through its impact on satisfaction. We tested this model using SEM, as described next.

3. Methodology

3.1.Research Context and Sample

The study was conducted in early 2025 and focuses on employee turnover in the Macedonian IT industry. We administered a survey targeting IT professionals across various Macedonian organizations. Respondents were recruited through professional networks that shared this request with their members, IT associations, and different online platforms including social media. We are aiming to capture a broad cross-section of the industry (including software developers, engineers, system administrators, IT project managers, etc.). Participation was voluntary and anonymous. We obtained a total of N = 174 valid responses, which provided the data for our analysis. The sample covered a diverse demographic range. About 33% of respondents were women and 67% men. The average age was approximately 34.7 years (SD ≈ 6.4 years). In terms of organizational role, roughly 68% of participants were non-managerial staff (e.g. developers, analysts) and 32% held leadership or managerial positions (team leads, department heads, etc.). The respondents represented organizations of varying sizes, from small start-ups to large companies. A plurality worked in small-to-medium enterprises (with 10-249 employees), while others came from micro firms (<10 employees) or large firms (>250 employees). Notably, 88% of the sample were employed on full-time permanent contracts, reflecting generally stable employment conditions; despite this, many reported that they still frequently consider job changes or entertain outside offers. This context in an expanding IT sector with ample opportunities and some ongoing brain drain makes it imperative to understand why employees may intend to leave and how organizations might intervene to improve retention.

3.2.Survey Instrument and Measures

We developed a comprehensive questionnaire with approximately 45 items, covering demographics and key constructs of interest. Three central latent constructs were measured using multiple survey items on 5-point Likert-type scales (1 = strongly disagree / very unlikely, 5 - strongly agree / very likely). These latent variables, along with their observed indicators (survey questions), are summarized in Table 1. The item wording for each construct was developed based on established literature and adapted to the local context, ensuring content validity. We conducted a pilot test with a small group of IT employees (not included in the main sample) to ensure the clarity and relevance of the items, making minor refinements before full deployment. Turnover Intention (Intent to Leave) was measured with two forward-looking questions capturing the respondent's inclination to quit their current job. One item (coded A1) asked: "How often do you think about leaving your current job?" (1 = Never; 5 - Very Often). A second item (coded A2) asked: "What are the odds you would accept a job in another organization if it offered the same compensation as your current job?" (1 = Very low; 5 = Very high). These two indicators were designed to tap the frequency of quit thoughts and the likelihood of acting on those thoughts given an equal offer elsewhere. Job Satisfaction was measured with five items (coded C2, C5, C8, C11, D3) covering different facets of satisfaction. Respondents were prompted with the stem "How much do you agree with the following statements about your current job?" and rated items such as C2: "I am satisfied with the benefits I get (compensation and perks)."; C5: "Managers in the organization clearly explain the tasks that should be done." (reflecting role clarity); C8: "I like the people I work with." (coworker relations); C11: "My work schedule enables me to have enough time for family and personal activities." (work-life balance); and D3: "I am satisfied with my chances to be promoted." (career advancement opportunities). These items cover both intrinsic and extrinsic aspects of job satisfaction relevant to IT professionals (from interpersonal relations and work-life balance to compensation and growth opportunities). Organizational Culture was measured with two items (coded E3, E4) that capture employees' perceptions of the workplace culture. E3 stated: "In my organization, it is easy to achieve understanding on important matters even when opinions differ." thus reflecting an open communication and conflict resolution climate. E4 stated: "The mission of my organization is clearly defined and it inspires employees to fulfill the goals." reflecting clarity of organizational vision and its motivational impact. These two items were chosen to represent key cultural dimensions (communication climate and shared mission) that are thought to influence satisfaction and

retention.

Each set of items was intended to load on its respective latent factor (Turnover Intention, Job Satisfaction, Organizational Culture). We coded all items such that a higher score indicates more of the latent construct (higher intent to leave, greater satisfaction, or more positive culture perception). Using multiple indicators per construct allows us to model and adjust for measurement error and to improve reliability. Table 1 provides an overview of the latent variables and their observed indicators.

Table 1: Latent Variables and Observed Indicators (Survey Items)

Latent Construct	Observed Indicators (Code and Item Text)
Turnover Intention (Intent to Leave)	A1 "How often do you think about leaving your current job?" (1 = Never; 5 = Very Often) A2 "What are the odds you would accept a job in another organization if it offered the same compensation?" (1 = Very low; 5 = Very high)
Job Satisfaction	C2 "I am satisfied with the benefits I get (compensation and perks)." C5 "Managers in the organization clearly explain the tasks that should be done." (role clarity) C8 "I like the people I work with." (coworker relationships) C11 "My work schedule enables enough time for family and personal activities." (work-life balance) D3 "I am satisfied with my chances to be promoted." (career advancement opportunities)
Organizational Culture	E3 "In my organization, it is easy to achieve understanding on important matters even when opinions differ." (open communication culture) E4 "The mission of my organization is clearly defined and it inspires employees to fulfill the goals." (clear & inspiring mission)

After data collection, we conducted reliability analysis on each multi-item scale. The Job Satisfaction scale (5 items) had a Cronbach's alpha of 0.79, indicating acceptable internal consistency. The Organizational Culture scale (2 items) yielded an alpha of 0.70, which is reasonable given the scale's brevity (with 2 items, Cronbach's alpha is limited and we also note that the correlation between E3 and E4 was moderate, suggesting they tap related aspects of culture). The Turnover Intention scale (2 items) had a Cronbach's alpha of approximately 0.68-0.70 (with the two items correlating at about $r \sim 0.5$-0.6), indicating a moderate correlation between thinking of leaving and willingness to leave for an equal offer. These reliability results suggest that the indicators consistently measure their intended constructs. In the SEM's measurement model, we also examined factor loadings for each indicator: all loadings were well above the common threshold of 0.50 (most were >0.70) and were statistically significant ($p < 0.001$), confirming that each observed item strongly associates with its latent factor and providing a solid measurement foundation for the structural model.

Additionally, we measured Experience as a single observed variable (in years). Respondents reported their total work experience in the IT industry. We included this as a control because prior literature suggests that more experienced employees can have different turnover tendencies. Sometimes lower intent to leave due to higher job stability or fewer external opportunities. In our analysis, Experience is treated as an exogenous predictor of turnover intention (with the hypothesis that experience has a negative effect on intent to leave).

3.3. SEM Analytical Approach

We employed Structural Equation Modeling (SEM) to test the hypothesized relationships between Organizational Culture, Job Satisfaction, and Turnover Intention, while controlling for Experience. SEM was chosen for its ability to simultaneously estimate multiple relationships and to incorporate latent variables (for culture, satisfaction, intention) that account for measurement error in the observed indicators. It also provides overall model fit indices to assess how well the theoretical model matches the observed data. We used a two-step modeling approach: first specifying a measurement model (to confirm that the survey items load on their intended latent factors as per Table 1), and then a structural model (to specify the directional paths between the latent constructs). Based on our theoretical framework, we

defined a mediational structural model:

Organizational Culture (exogenous latent variable) → Job Satisfaction (mediator latent) → Turnover Intention (ultimate endogenous latent).

This reflects our hypothesis that culture influences turnover primarily through its impact on satisfaction. We included the direct path Job Satisfaction → Turnover Intention (which we expected to be a significant negative relationship, given extensive prior evidence). We also included a direct path Organizational Culture → Job Satisfaction (expected to be significantly positive). Initially, we considered adding a direct path Organizational Culture → Turnover Intention (to test whether culture has an independent effect on intention to leave beyond its indirect effect through satisfaction). However, adding this direct culture→turnover path did not improve model fit significantly and the path was not significant, suggesting full mediation. For parsimony, our final model omitted the direct culture→turnover link, aligning with a fully mediated structure in which culture's influence on turnover operates via satisfaction. Lastly, we included Experience (observed, in years) as an exogenous predictor of Turnover Intention, to control for any linear effect of tenure on intent to leave. We hypothesized a negative effect (longer experience → lower intent), though this was exploratory. In the model, Culture and Experience were allowed to covary, since both are exogenous inputs to the turnover equation (it is plausible, for example, that more experienced employees might systematically be in organizations with certain cultural characteristics, though in our data we did not find strong correlations between tenure and culture perceptions). The SEM was estimated using Maximum Likelihood (ML) estimation in Stata 17. Given that our Likert-scale indicators can be treated as ordinal, we also ran a robustness check using an estimator suitable for ordinal data (WLSMV in Mplus); it yielded substantively similar results for the structural paths, so we proceeded with ML for simplicity. We checked the data for normality and outliers and found no severe deviations (Likert items had roughly symmetric distributions without excessive skew). We report standardized path coefficients for ease of interpretation. We evaluated model fit using standard goodness-of-fit indices: the chi-square test, RMSEA (Root Mean Square Error of Approximation) with its 90% confidence interval and p-close, CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), and SRMR (Standardized Root Mean Square Residual). Good model fit is typically indicated by a non-significant chi-square (or a chi-square/df ratio < 2), RMSEA < 0.06 (with p-close > 0.05), CFI and TLI > 0.95, and SRMR < 0.08. We also looked at the model's explanatory power (R^2 for the endogenous variables).

4. Results

Measurement Model

The confirmatory factor analysis for the measurement model showed that each item loaded strongly on its intended latent factor, as noted earlier. All factor loadings were highly significant ($p < 0.001$) and most were above 0.7. This provided confidence in the convergent validity of our constructs. There was sufficient discriminant validity as well: the correlation between the latent factors remained moderate (culture-satisfaction correlation was positive and significant, satisfaction-turnover correlation was negative and significant, culture-turnover correlation was weaker once controlling for satisfaction). These patterns align with expectations. We also calculated composite reliability (coefficient H) for each construct, which were satisfactory (> 0.7). Thus, the measurement model was deemed acceptable, allowing us to proceed to the structural relationships.

Structural Model Fit

Our SEM achieved an excellent fit to the data. The chi-square test was non-significant ($\chi^2(33) = 46.19$, $p = 0.063$), indicating that the model's covariance structure did not differ significantly from the observed data a desirable result signifying close fit. Other fit indices were well within recommended thresholds for a good model: RMSEA = 0.048 (90% CI [0.000, 0.078], p_close = 0.512), suggesting a close approximate fit; CFI = 0.981, TLI = 0.974, both well above the 0.95 benchmark; and SRMR = 0.038, below the 0.08 threshold. In combination, these indices indicate that our hypothesized relationships among culture, satisfaction, and turnover intention adequately explain the patterns in the data. The model's coefficient of determination (R^2) for the Turnover Intention latent variable was 0.907, meaning the model explained about 90.7% of the variance in employees' turnover intentions. This very high R^2 suggests that the two predictors in the model (job satisfaction and experience, with culture feeding into satisfaction) capture the dominant influences on intent to leave in our sample. It is not uncommon for an R^2 to be high in an SEM context with a strong mediational effect; here it implies that, within this population, differences in culture and satisfaction (as reported by employees) almost completely account for differences in their intentions to quit.

Key Structural Path Estimates:

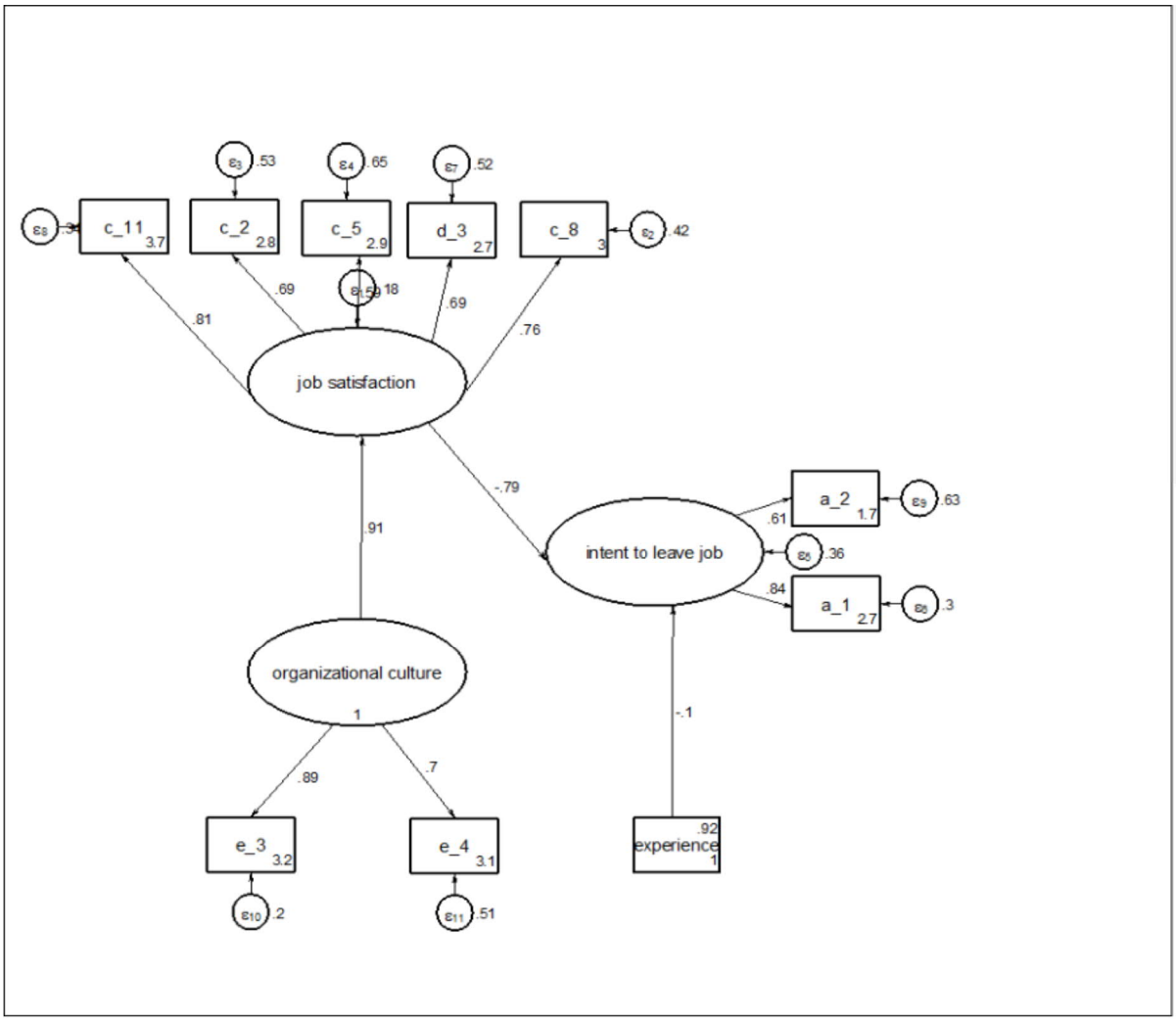

Figure 1 depicts the simplified path structure of our final SEM model, showing the latent variables as ovals and observed variables as rectangles (for clarity, only the latent-level paths are labeled; factor loadings for the indicators are omitted in the figure but were all high). The figure also notes which variables are treated as exogenous or endogenous in the model. We summarize the key findings from the structural model below.

Figure 1. SEM path model linking Organizational Culture, Job Satisfaction, and Turnover Intention (latent variables shown as ovals, observed indicator variables as rectangles). Standardized path coefficients are indicated on the arrows. "Experience" is an observed exogenous control. All shown coefficients are significant at $p < 0.001$, except the path from Experience to Turnover Intention, which was not significant (n.s.).

Organizational Culture → Job Satisfaction

We found a strong positive relationship between organizational culture and job satisfaction. The standardized path coefficient was $\beta = 0.833$ ($p < 0.001$). This indicates that a one standard deviation improvement in perceived culture is associated with a 0.833 standard deviation increase in overall job satisfaction, holding other factors constant. In practical terms, if an organization cultivates a more open, supportive, and mission-driven culture, employees' satisfaction with their jobs rises considerably. This result aligns with prior studies suggesting that culture "sets the tone" for employee morale for example, when employees agree that management is transparent and that "we have a clear, inspiring mission," they tend to report higher satisfaction across various aspects of their job. In our data, the two culture indicators (communication climate and clear mission) both loaded well on the culture factor (loadings ~0.78-0.80), and the strong culture→satisfaction path confirms that those cultural elements are substantial predictors of how content employees feel at work. This finding underscores the socio-technical notion that social-environment factors (like culture) can significantly enhance human outcomes (like satisfaction) within a work system.

Job Satisfaction → Turnover Intention

As expected, job satisfaction had a significant negative effect on employees' intent to leave. The standardized coefficient was $\beta = -0.799$ ($p < 0.001$). In other words, a one standard deviation increase in job satisfaction corresponded to roughly a 0.80 standard deviation decrease in turnover intention. This is a large effect, underscoring that satisfaction is a primary driver (or rather, a deterrent) of turnover considerations. Simply put, the more satisfied employees are, the less likely they are to be thinking about quitting. This finding is highly consistent with the broad literature on turnover and confirms that job satisfaction plays a critical mediating role between organizational conditions and retention outcomes. In our sample, this implies that interventions aimed at improving job satisfaction for example, enhancing the facets captured by our C2, C5, C8, C11, D3 items (pay/benefits, management clarity, team relationships, work-life balance, career opportunities) can significantly reduce the proportion of employees contemplating leaving. We also note that the two turnover intention indicators (A1 and A2: frequency of thoughts of leaving, and likelihood of accepting a same-pay offer elsewhere) both had very high loadings on the latent factor (one was fixed at 1.0 for identification, the other was ~0.94), indicating they are nearly interchangeable in reflecting the underlying intent-to-leave construct. The strength of the inverse satisfaction→turnover link in our model (nearly -0.8) suggests that, in this context, low job satisfaction is almost tantamount to high turnover intent a clear call to action for management to monitor and bolster employee satisfaction levels.

Organizational Culture (indirect effect) ⟶ Turnover Intention

In the final model, the effect of organizational culture on turnover intention is fully mediated by job satisfaction. We did not find a significant direct path from culture to intent to leave once satisfaction was accounted for, so we constrained that direct path to zero in the final model for parsimony. This implies that culture influences turnover essentially by first influencing how satisfied employees are. Intuitively, culture by itself might not directly make people stay or leave; rather, culture affects daily work experiences and climate (e.g. a good culture fosters positive experiences that yield satisfaction, whereas a bad culture breeds frustration and dissatisfaction), and those experiences drive turnover intentions. We did test a model variant where culture directly affected turnover intent, but that path was weak and, somewhat tellingly, caused the model to overfit (the chi-square statistic went to zero, indicating a saturated model that was likely modeling noise). Therefore, our results support the view that job satisfaction is the key mechanism through which higher-level organizational factors like culture ultimately impact an individual's decision to stay or leave=. For practitioners, this is an important insight: it means that even if you improve your organizational culture (say, by encouraging better communication or a stronger mission), you need to ensure those improvements actually translate into concrete improvements in employees' day-to-day job experiences (their satisfaction) in order to affect turnover. Simply having a nice mission statement on the wall won't retain people unless it influences things that matter to their jobs.

Experience ⟶ Turnover Intention

The control variable, employee experience (in years), was included to account for any systematic relationship between tenure and intent to leave. We hypothesized that more experienced employees might have lower intent to leave (perhaps due to better positions, more loyalty, or fewer outside opportunities), but our model found that Experience's effect was not statistically significant. The path coefficient was near zero and non-significant (labeled "n.s." in Figure 1). This suggests that, in our sample, an employee's total work experience did not have a meaningful linear impact on their turnover intentions when culture and satisfaction were already taken into account. It appears that regardless of whether someone was relatively junior or very experienced, what really drove their intent to leave was how they felt about their job and organization now. (It is possible that experience might relate to turnover intentions in more complex ways for instance, perhaps mid-career professionals are most mobile but our data did not show a clear pattern and it wasn't a primary focus here.). In addition to these core SEM findings, some descriptive results from the survey provide context and reinforce the SEM conclusions. For instance, we observed that a notable fraction of respondents frequently think about leaving: about 22% of participants answered 4 ("often") or 5 ("very often") to the question about thinking of leaving their job. Likewise, those who reported dissatisfaction on key items (like dissatisfaction with pay or promotion opportunities) were much more likely to show high turnover intentions. These patterns illustrate the practical reality behind the statistics: there is a significant subset of Macedonian IT employees who are at risk of leaving, and their reasons often tie back to remediable factors in the work environment. Overall, our quantitative results strongly support the idea that improving organizational culture and job satisfaction can dramatically reduce employees' intent to leave. With these relationships established, we now turn to discussing how these insights can be applied in designing better socio-technical systems and HR interventions in organizations.

5. Implications for Socio-Technical Systems Design

The findings carry important implications for how organizations should design and implement their

information systems, work processes, and management practices essentially, how to (re)engineer socio-technical systems to be more human-centered. A core lesson from this research is that social factors like culture and job satisfaction are not just ancillary outcomes or "HR issues," but critical design parameters for effective and sustainable work systems. High turnover, in this view, is more than a staffing problem it can be interpreted as a symptom of deeper misalignments in the socio-technical system. If employees are consistently dissatisfied or disengaged, it signals that the current design of the work system (tasks, roles, communication structures, reward systems, etc.) is failing to meet their needs or expectations. From a sociotechnical perspective, such misalignment must be addressed by adjusting the social and/or technical elements of the system ideally in tandem to better fit the people in the system. Below, we propose several actionable recommendations, informed by our results and guided by socio-technical design principles (especially Enid Mumford's ETHICS methodology and related human-centered design approaches). These suggestions illustrate how an IT organization could intervene to improve organizational culture and job satisfaction, thereby mitigating turnover intention. Each recommendation treats reducing turnover as a design goal of the organizational system, not just an after-the-fact outcome.

1. Embed Job Satisfaction Goals into IS Design

When designing or introducing new information systems or processes, explicitly include "maximize job satisfaction" as a key objective alongside traditional technical and efficiency objectives. This echoes Mumford's ETHICS approach, which reminds us that system success should be measured in human terms as well as technical terms. Practically, for an IT company, this means that any new tool, software, or workflow should be evaluated for its impact on employees' day-to-day work experience. For example, if a new project management software is being rolled out, the design/review team should ask: Will this tool make employees' tasks clearer or more confusing (addressing item C5 on role clarity)? Does it streamline work or inadvertently increase workload? If a new policy for flexible work is implemented, consider Does it truly allow employees to better balance work and personal life (addressing C11 on work-life balance)? Similarly, when implementing a new HR system or performance evaluation process, one design criterion should be how it can facilitate fair and transparent career advancement (relating to item D3 about promotion opportunities). Our research identified these facets clarity, relationships, work-life balance, advancement opportunities as important to job satisfaction; therefore, system designers and managers should treat them as requirements. By incorporating such human-centric criteria into the design and selection of technologies/processes, the resulting socio-technical system is more likely to yield a positive impact on job satisfaction and, by extension, reduce turnover intent. This approach aligns with ETHICS' advocacy for joint optimization (achieving both high technical performance and high quality of working life) and with modern Human-Centered Design principles that focus on the end-user experience. In sum, design for the employee experience, not just for technical functionality doing so will likely result in more engaged, loyal staff and lower turnover.

2. Use Participative Design to Improve Culture

A salient tenet of socio-technical theory (and ETHICS in particular) is the active involvement of end-users
(employees) in design and decision-making. Our findings suggest that organizational culture especially aspects like open communication (E3) and having an inspiring mission (E4) is crucial for satisfaction and retention. One effective way to strengthen these cultural aspects is through participative management and design. When employees are invited to contribute ideas on how to improve their work systems or to help solve organizational problems, it not only yields better solutions (leveraging employees' frontline knowledge) but also makes them feel valued and heard. This participatory climate directly reinforces a positive culture. It builds transparency, and a sense of ownership among staff. According to the ETHICS method, employees who help design their own work situation will be more committed to making it succeed. In practice, organizations could establish cross-functional teams or committees to tackle issues that employees are dissatisfied with. For example, create an employee task force on improving work-life balance (perhaps to brainstorm flexible scheduling or remote work policies), or a committee that involves employees in refining the company's mission statement and finding ways to better communicate that mission internally. By involving employees in these socio-technical (re)design processes, management sends a powerful signal that it respects the "social" system needs as equal to technical or business needs. This inclusion can increase job satisfaction because work conditions improve in ways employees themselves recommended and reduce intent to leave, since people feel they have a stake in shaping a better workplace rather than feeling the need to quit for change elsewhere. In essence, participative design is both a means to an end (better-designed systems that

incorporate user input) and an end in itself (a cultural norm of involvement that boosts satisfaction and retention). It operationalizes the principle that "people should be able to influence the design of their own work," a principle vindicated by our data showing how critical work conditions are to retention. Managers in IT firms should therefore look for structured ways to involve employees in decision-making about changes whether through surveys, workshops, or design committees to cultivate a culture of inclusion and continuous improvement.

3. Strengthen Culture through Alignment and Communication

The two culture items in our study point to specific areas for intervention: (a) ensuring it is easy to reach understanding even when opinions differ (open communication and constructive conflict resolution), and (b) having a clear, inspiring organizational mission. To improve the first area, organizations should evaluate and possibly redesign their communication systems both technical tools and social practices to promote inclusive dialogue. From a technical standpoint, this might involve implementing or configuring collaboration platforms, knowledge-sharing tools, or anonymous feedback channels that enable all voices to be heard. From a process standpoint, it could include regular town-hall meetings, training leaders in facilitation skills, and establishing norms for respectful debate. For example, a socio-technical design approach to communication would ensure that any new information system includes features for transparency (so everyone has access to the same information, reducing rumor and misunderstanding) and feedback loops (so employees can easily provide input upstream). Such mechanisms reinforce a culture of openness, leading to greater consensus and employees feeling "heard," which in turn boosts satisfaction. Regarding the second aspect (mission clarity and inspiration), organizations should strive for organizational alignment in any change initiative. This means clearly linking the goals of a new system or process to the broader mission of the organization, and communicating that link effectively to employees. Under a sociotechnical change project, management needs to craft a compelling change narrative not just what is changing, but why it's important and how it serves the organization's purpose. For instance, if a new software tool is introduced, explain how it will help the company deliver on its mission (e.g. "This new project management platform will help us collaborate better, so we can achieve our mission of delivering innovative solutions to clients faster"). If employees understand and believe in the mission, and see how their work and the tools they use contribute to that mission, they derive a greater sense of purpose a key ingredient of engagement and satisfaction. Thus, design the social messaging and training around new systems as carefully as the technical features, to reinforce a culture of shared purpose. This approach resonates with human-centered transformation strategies that stress the importance of engaging employees (not just top management) in defining the "why" of change and ensuring the change meets their needs as well. Ultimately, culture change and technology change should be pursued hand-in-hand: e.g., if you install a new communication tool, also foster norms of open communication; if you clarify the mission statement, also make sure your systems and workflows visibly support that mission.

4. Implement Iterative Feedback and Continuous Improvement

Designing a socio-technical system is not a one-off project it requires ongoing adaptation. After implementing changes aimed at improving satisfaction or culture, organizations should measure their impact and be willing to adjust course. This means treating improvements in culture and satisfaction as hypotheses to be tested: for example, if you introduce a flexible scheduling policy to improve work-life balance, follow up after a few months with surveys or focus groups to see if it actually helped, or if there were unintended side effects. If a new project management tool was supposed to clarify tasks (item C5) but employees still report confusion, perhaps the issue lies in insufficient training or information overload, suggesting that additional tweaks or support are needed. By "closing the loop" and continually gathering feedback, companies can fine-tune the alignment between technology and social needs. This approach parallels agile and user-centered design methods in software development (frequent iterations based on user feedback), except here the "users" are the employees and the "system" is the workplace itself. Over time, this responsiveness can become part of the culture a culture that values continuous improvement and employee well-being. Research on human-centered design and continuous improvement suggests that addressing root causes of employee pain points (by repeatedly asking "why" and iterating solutions) leads to more supportive systems and better employee experiences. In our context, that translates to sustained high satisfaction and low turnover intent. Organizations may even integrate such feedback loops formally (e.g., a standing employee experience committee that reviews survey data quarterly and suggests adjustments to policies or tools). The goal is to make the socio-technical system resilient: able to evolve as

employees' needs or external conditions change, thereby preventing new sources of dissatisfaction from taking root.

5. Make Turnover Reduction a Systemic Goal

Finally, organizations should recognize that reducing turnover is not solely an HR responsibility but a system-wide goal that ties into socio-technical optimization. High turnover can be seen as a failure of the work system to achieve joint optimization perhaps the system maximized output or profit at the cost of human factors, which is unsustainable. With our findings, managers (especially in IT companies) have evidence that to keep talent, they must invest in the social design of work at least as much as in technical infrastructure. This includes intangible but crucial elements like building a sense of community (so that the statement "I like the people I work with" item C8 is true for employees) or ensuring fair recognition and career development (so that good performers don't feel they need to leave to advance item D3). These elements should be formally considered as part of system requirements in any organizational development initiative. For example, when overhauling a company's internal processes or tools, one might add a requirement like: "The new system should allow employees to easily document and showcase their achievements to support fair promotions." A requirement like this is socio-technical in nature: it implies certain technical features (maybe an employee portfolio or achievements dashboard in a software platform) driven by a social objective (improving perceived fairness and career growth). Achieving it could increase satisfaction with career opportunities and thus reduce turnover intent. More broadly, by designing the organization as a whole its technology, processes, and culture to support employee well-being, we create a more resilient system where fewer people want to exit. This approach is supported by modern case studies and industry reports: companies that apply human-centered design to improve the employee experience often see improvements in retention as a direct outcome. In the competitive IT industry, such retention can become a source of competitive advantage, as lower turnover means a more stable, experienced, and productive workforce.

6. Conclusion

This paper presented an investigation into employee turnover in Macedonia's IT sector through a sociotechnical systems perspective, blending empirical analysis with human-centered design considerations. We examined how organizational culture and job satisfaction interact to shape turnover intentions, thereby highlighting the human factors underlying employee retention in a technological work context. Using Structural Equation Modeling (SEM) on survey data, we validated a model wherein a positive organizational culture boosts job satisfaction, which in turn dramatically reduces an employee's intention to leave. These results are more than just statistical relationships, they tell a story consistent with sociotechnical theory that when people's social and psychological needs in the workplace are met, technical systems perform better because the people operating them are motivated to stay and contribute. Conversely, neglecting those needs (e.g. allowing a poor culture or low satisfaction to fester) can lead to a drain of talent that ultimately undermines the organization's performance. We framed the problem of high turnover as one of socio-technical misalignment essentially, a gap between what the technology-centric design of work offers and what humans in the system desire or need. To bridge this gap, we drew upon Enid Mumford's ETHICS methodology and similar participatory, human-centric approaches. These provide concrete strategies (like involving users in system design and setting job satisfaction as an explicit success criterion) to realign work systems with human needs. In discussing implications, we offered a five-point roadmap for IT organizations and information system designers, which includes embedding job satisfaction into design goals, using participative design to improve culture, aligning technological changes with a clear communication strategy, iterating based on feedback, and treating turnover reduction as a systemic objective. The common thread is that organizations should consciously craft both their technical tools and their social practices in ways that promote a healthy culture and fulfilling jobs. Doing so is not merely altruistic; it directly contributes to organizational sustainability by reducing costly turnover and improving overall performance. As one study noted, the inverse relationship between job satisfaction and turnover is especially pronounced among younger workers a generation that often values meaningful work and positive culture suggesting that as the workforce evolves, employee experience will play an even greater role in retention success. Organizations that proactively design their socio-technical systems to enhance that experience stand to gain a competitive advantage in keeping talent. For the academic and practitioner community at STPIS 2025, our work demonstrates the value of integrating socio-technical systems theory with empirical data from a real-world context (the Macedonian IT industry). Theoretically, it reinforces

longstanding socio-technical assertions with fresh evidence confirming, for example, that ignoring "soft" issues like culture and satisfaction can have "hard" consequences like employee turnover. Methodologically, it illustrates how SEM can be used to analyze and quantify socio-technical phenomena, a useful approach for other contexts where multiple latent factors determine IS outcomes. Practically, it offers evidence-based recommendations that align with ongoing human-centered design trends in organizations. In an era of rapid technological change and digital transformation, our findings serve as a reminder that the success of any information system or organizational change ultimately hinges on human factors. No matter how advanced a technical system is, if it frustrates or alienates the people using it, the organization will suffer often visibly through the loss of those people. We conclude that addressing employee turnover requires a holistic, socio-technical approach. By improving organizational culture (the social system) and aligning it with well-designed jobs and processes (the technical system) to foster employee satisfaction, companies can create a virtuous cycle of engagement and retention. Future research could build on this work by examining additional factors that might influence the socio-technical equation for example, different leadership styles, specific job design characteristics, or external job market conditions and how they interact with culture and satisfaction in predicting turnover. It would also be valuable to conduct intervention studies: for instance, action research in which an organization implements the kind of participatory, human-centered changes we recommend (perhaps using ETHICS or similar methods) and then observes the impact on employee satisfaction and actual turnover rates over time. Another promising avenue is to explore socio-technical alignment in emerging work arrangements (such as remote or hybrid work in IT), which introduce new challenges for maintaining a strong culture and employee satisfaction when teams are virtual. In closing, our study reinforces a simple yet profound point: people are at the heart of every technical system. Alignment between organizational culture, job design, and technology is not automatic; it must be intentionally cultivated. Socio-technical perspectives and methodologies like ETHICS provide the wisdom and tools to do so. As organizations strive to be more agile, digital, and efficient, they must equally strive to be places where employees feel satisfied, valued, and purposeful. The outcome will be not only lower turnover, but also higher employee engagement, better adoption of new technologies, and ultimately more robust organizational performance truly achieving the dual goals of socio-technical optimization: excellence in technical performance and quality in people's work lives.

Declaration on Generative AI

The authors have not employed any Generative AI tools.

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