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Mitigating the Impact of Member Turnover in Information Systems Development Projects

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Abstract

Team member turnover presents significant risks to the performance of information systems development (ISD) projects. While prior studies have identified various antecedents of turnover with the general objective of reducing its occurrence, turnover cannot be completely prevented in practice. This study examines practices for mitigating the negative impact of turnover when it occurs. Since ISD is knowledge-intensive and turnover typically involves knowledge degradation, this study focuses on key practices for reducing such knowledge degradation i.e., job enlargement, use of electronic knowledge repositories, and succession planning. Our model for explaining the effects of the practices, based on the human capital and organizational forgetting theories, is tested through a survey of 138 project managers of ISD teams experiencing turnover. The results indicate that the use of electronic knowledge repositories and succession planning reduce the negative effect of turnover on project performance. In contrast, job enlargement does not have a significant mitigating effect. This study contributes to research by looking beyond the antecedents and prevention of turnover to understand how it can be managed effectively. The findings also offer pragmatic suggestions for alleviating the detrimental effects of team member turnover on ISD project performance.

1. Introduction

Information systems development (ISD) is an endeavor plagued by various risks [1] that can result in project failure if they are not carefully managed. A survey conducted by Gartner in the US, Canada, France, Germany, and UK in 2012 showed that 20 to 28 percent of information technology (IT) projects failed for various reasons [2]. Among them, turnover of project team members presents significant risks that must be coped with [3]. Member turnover often involves the undesirable loss of valuable members and their knowledge and experience. It can render parts of a project's memory (e.g., processes, contexts, and artifacts) inaccessible [3, 4] and negatively impact project performance by incurring extra costs of hiring and training [5, 6], delaying progress [7], and dampening team morale [8]. It is therefore valuable to understand how the negative impact of such turnover can be managed.

Although the topic of turnover has drawn much research attention, our literature review (detailed in the next section) indicates that prior information systems (IS) as well as management research [9, 10] have focused predominantly on the *antecedents* and *impacts* of turnover. Understanding the causes of turnover is key to helping prevent its occurrence. However, turnover is seldom completely avoidable in practice [11]. Industry surveys show that retaining IT professionals remains challenging, with about 40 percent of IT professionals indicating that they intend to search for new job opportunities [e.g., 12]. Thus, there is a need for both IS and management research to look beyond the causes of turnover and examine how its negative impact can be effectively mitigated when it occurs. Since ISD is a knowledge-intensive endeavor that requires the expertise, insights, and skills of many individuals to be integrated, it is particularly important to identify practices that can help to retain knowledge in the event of turnover [13].

While some turnover may be initiated by the organization to eliminate poor performers or reduce costs [14], in this study we examine *voluntary* turnover initiated by

employees. Voluntary turnover is typically more detrimental because it involves unwanted loss of members and knowledge available to work on a project. Further, we focus on *external* turnover, i.e., when members leave an ISD project team as well as the organization during the project[1], as opposed to internal turnover in which members depart from the project team but stay in the organization and thus could be reachable. External turnover is typically more damaging because established knowledge can become inaccessible and even permanently lost with the departure of a member. This agrees with the human capital view whereby turnover is seen to reduce organizational performance through the loss of employee knowledge and skills [15]. Failure to maintain established knowledge, conceptualized as knowledge degradation in the organizational forgetting theory [16], has been found to stretch a project's schedule, drain its budget, and negatively impact project performance [17, 18]. Yet, little is known in the literature about what practices can effectively reduce knowledge degradation to mitigate the negative impact of turnover on ISD project performance.

Motivated thus, this study addresses the research question: "*What practices for managing knowledge degradation can mitigate the negative impact of member turnover on ISD project performance?"* As per the organizational forgetting and human capital theories, we attribute the negative effect of member turnover in part to the consequent knowledge degradation in the ISD team. Subsequently, based on related research on ISD, knowledge management (KM), and IT professionals' turnover, we identify the practices of job enlargement, use of electronic knowledge repositories, and succession planning as potentially useful for reducing knowledge degradation due to turnover. We then develop our theoretical model in which these practices are posited to moderate the negative impact of turnover on ISD project performance. Results from testing the model through a survey of 138 project managers of ISD teams experiencing turnover indicate that the use of knowledge repositories

[1] Henceforth in the paper, turnover refers to voluntary external turnover.

and succession planning are effective while the practice of job enlargement is not. This study makes research contributions by looking beyond the antecedents and prevention of turnover to examine the practices for managing its negative impact. For practitioners, it pinpoints specific practices that effectively buffer ISD projects from the detrimental effects of turnover.

2. Conceptual Background

In this section, prior research on IT professionals' turnover will first be reviewed to identify gaps in our understanding. Theoretical perspectives on the impact of turnover and the concept of knowledge degradation from the organizational forgetting theory will then be described to explicate the impact of turnover. Subsequently, based on relevant research on ISD, KM, and IT turnover, potential practices for mitigating the negative impact of turnover on ISD project performance will be identified and discussed.

2.1 Research on IT Professionals' Turnover

Turnover of IT professionals has been an area drawing considerable research interest [19]. In a review, Joseph et al. [20] organized the factors examined in such studies published before September 2005 using March and Simon's [21] distal-proximal turnover framework. They observed that most studies had focused on identifying the antecedents of individual's turnover intention related to the desire to move between jobs (e.g., job satisfaction), ease of movement (e.g., perceived job alternatives), job search behavior, individual attributes (e.g., age, gender), job-related factors (e.g., job autonomy), and organization-related factors (e.g., reward systems). To examine how research on IT professionals' turnover has progressed since the review, we use the same framework to organize studies published from September 2005 to September 2013 (see Appendix A for our review). It can be seen that the vast majority of the recent studies (23 out of 24) continue to focus on turnover antecedents. Other than the antecedents summarized in Joseph et al.'s [20] review, subsequent studies have identified additional turnover antecedents such as emotional dissonance [22], lack of job

meaningfulness [23], and "shocks" such as unsolicited job offers [24].

Other than the antecedents, prior studies have also examined the performance impacts of turnover. In our review of empirical studies after 2005, one study assessed the impact of turnover [6] on software projects' profit. This and earlier studies on the performance impact of turnover in IS projects are summarized in Table 1. Of the six studies in Table 1, four conducted surveys to assess the impact of turnover, one analyzed simulation models [25], and the remaining paper involved multiple case studies [5]. None of the studies examined practices mitigating the impact of turnover. Thus, there is a clear lack of research on the management of turnover impacts in ISD projects.

Table 1. Studies on the Performance Impact of Turnover in ISD Projects

Study	Dependent Variable (DV)	Observed Impact of Turnover
Abdel-Hamid [25]	Project Cost, Project Duration	Positive
Dibbern et al. [5]	Extra Project Cost	Positive
Yetton et al. [26]	Extra Project Cost	Positive
Black and Lynch [27]	Productivity	Negative
Gopal and Sivaramakrishnan [6]	Expected Project Profit	Negative
Gopal et al. [28]	Realized Project Profit	Insignificant

Our review (see Appendix A) also indicates that most prior studies have employed individual IT professionals' turnover intention as a proxy measure of actual turnover and examined turnover at the individual level. However, studies have shown that turnover intention may not always be an effective predictor of actual turnover [e.g., 29]. This suggests that measuring actual turnover may be more valid when feasible. Along these lines, Bartol et al. [30, p. 53] stated that "the magnitude of the turnover problem and the potential disruption to information systems projects calls for concentrated research in this area. In order to be useful, such research efforts must include measures of actual turnover".

Overall, our review reveals that there is a lack of research and understanding on practices mitigating the negative impact of turnover. Yet, studies (e.g., [5]) have recognized that turnover presents significant challenges to ISD and highlighted the need to manage its consequences. In a similar vein, management research has emphasized the importance of

looking beyond turnover at the individual level [31] and exploring how human resource practices may attenuate its negative impact [9, 31]. This study responds to these calls by modeling and assessing the impacts of actual team-level turnover and the moderating practices on ISD project performance.

2.2 Theoretical Perspectives on the Impact of Turnover

It is widely acknowledged that ISD projects are knowledge intensive in that they require the integration of both technical and business knowledge distributed among different members such as analysts, programmers, and domain experts [13]. Other than knowledge that members bring with them when they join a project, knowledge embedded into the system under development, knowledge related to the history of problem solving, and understanding of cultural intricacies related to the system are also developed as a project progresses [17]. It has been demonstrated that access to and integration of knowledge contribute significantly to IT project performance such as timely completion [32]. Thus, both human and social capital contribute towards project performance.

The human capital theory and social capital theory offer explanations for the performance impact of turnover in terms of diminishing these forms of capital [15]. The human capital theory suggests that turnover weakens performance by reducing the stock of human capital in the form of knowledge, skills, and abilities. Turnover is expected to have a negative linear relationship with performance since it diminishes human capital which directly relates to productivity and workforce performance [15, 33]. Social capital theory suggests that turnover reduces social capital by disrupting the knowledge embedded in social relationships. Such socially-embedded knowledge can provide competitive advantage to the firm because it cannot be easily copied or transferred and helps generate synergy that improves performance exponentially. As a result, when members occupying key positions in organizational social networks leave, performance could decline exponentially [34].

Although the human capital theory and social capital theory predict different forms of the relationship, they agree that turnover has an overall negative impact on performance. Considering that the focus of this study is on identifying effective practices mitigating the negative impact of *aggregate* turnover in a project team rather than the impact of specific members' turnover, and that there is strong empirical evidence for the linear effect of turnover on ISD project performance (as reviewed in Table 1), we adopt the perspective of human capital theory and model a linear impact.

2.3 Organizational Forgetting and Knowledge Degradation due to Turnover

The knowledge loss when turnover occurs is explained by the theory of organizational forgetting [16], which posits that knowledge in an organization may be accidentally forgotten or purposefully removed. While purposeful forgetting helps organizations discard obsolete and incompatible knowledge [35], accidental forgetting is often detrimental. Turnover is a key cause of the accidental forgetting of established knowledge, or *knowledge degradation*, as turnover could render even frequently used knowledge inaccessible [16]. To reduce knowledge degradation, the organization forgetting theory suggests that it is necessary to exert specific and constant effort towards knowledge retention activities. Similarly, management researchers have suggested that retaining knowledge can buffer the organization from the negative impact of turnover [e.g., 36].

Knowledge may be accumulated in members' mind or documented in the written form. Tacit knowledge refers to "an individual's mental models consisting of mental maps, beliefs, paradigms, and viewpoints" [37, p. 110]. It is difficult to codify and is often transferred through interpersonal relationships [38]. In contrast, explicit knowledge can be more easily codified and communicated in the written form [37]. In ISD projects, both explicit (e.g., software documentation) and tacit (e.g., cultural understanding) knowledge can dissipate with turnover and become difficult to recover if not shared with remaining members

[17]. It is therefore necessary to reduce the degradation of both tacit and explicit knowledge Management researchers have recommended potentially useful practices for this purpose. For instance, Stovel and Bontis [14] suggest that succession planning can reduce knowledge loss when turnover occurs. However, the effectiveness of this and other practices has not been empirically validated.

This study addresses the gap by modeling and testing the effects of practices that can potentially retain tacit and explicit knowledge and thereby help ISD project teams manage the negative impact of turnover. We identify practices that facilitate knowledge retention on a continual basis as well as when specific positions are expected to be vacated. Through a case study of employee departure, Starke et al. [39] suggest that job enlargement could promote ongoing transfer of tacit knowledge among employees and reduce the dependency on individual employees for tacit knowledge. In a conceptual paper on KM in software engineering, Rus and Lindvall [40] mentioned that explicit knowledge can be captured continuously in software organizations through the use of electronic knowledge repositories. Other researchers suggest that to retain tacit knowledge during turnover involving specific positions, succession planning could be useful [14, 25, 39]. In management research, a recent review mentioned that the negative impact of turnover can be actively managed through job design, technology, and workforce planning [31]. Accordingly, this study identifies job enlargement (a form of job design), the use of technology in the form of electronic knowledge repositories, and succession planning as practices that could alleviate the detrimental effects of turnover in ISD teams. Each of these practices is described next.

2.4 Practices that Could Alleviate the Negative Effects of Turnover

2.4.1 Job Enlargement

Job enlargement refers to the ongoing development of multi-functional team members through training or rotating tasks among members so that they become capable of performing

a wider range of team tasks [41]. It is implemented for various purposes including relieving job monotony, allowing flexibility of deploying employees for different tasks, and potentially grooming employees for larger roles through becoming familiar with different functions of the business. As a form of job enlargement, rotation of tasks provides employees with opportunities to experience different jobs and stimulates them to engage in sense making [42]. Immersing employees in the routines of others provides them access to and deeper understanding of others' tacit knowledge [43]. This can broaden employees' knowledge and skills and expand the "common cognitive ground" among them, which provides the basis for transferring tacit knowledge [44]. Job enlargement can also create knowledge redundancy such that valuable tacit knowledge is not tied to a single employee [44] and increase functional redundancy such that a team has the requisite variety to deal with fluctuations in human resources caused by turnover [41].

It has been suggested that rotating tasks among members in ISD projects is useful for sharing knowledge [40, 43] and developing shared understanding among members such as programmers and testers [45]. However, it remains unclear whether job enlargement can reduce the negative impact of turnover as a result. Since job enlargement incurs overheads such as time and learning effort, it is important to determine whether it is indeed effective in managing turnover.

2.4.2 Electronic Knowledge Repository

Electronic knowledge repositories mainly support the storage of explicit knowledge and facilitate knowledge transfer and reuse through providing access to codified knowledge [46]. Both the structure and content of a knowledge repository are important [47]. Structure provides the context for interpreting accumulated content in a repository. It may manifest in the form of schemes for linking and cross-referencing content, including conceptual associations, ordered sequences, causality, or other relationships depending on the nature and

domain of knowledge. A repository with flexible structure enables users to alter and combine views dynamically to apply the knowledge content to new circumstances or create new knowledge.

Electronic knowledge repository is suggested as a useful tool for supporting KM in ISD projects [40, 48]. A knowledge repository supporting ISD may include contents such as system design, user requirements [40], reusable codes, and details of completed projects [48]. Other than keeping track of the history of a project, repositories may be used in the initial phases of an ISD project to gain an overview of the problem or during a project to suggest solutions to technical problems [49]. Nevertheless, whether using knowledge repositories can mitigate the negative impacts of turnover on ISD project performance has yet to be examined.

2.4.3 Succession Planning

Succession planning refers to the identification and preparation of a successor to assume a specific job role that is expected to be vacated [50]. It is an approach for managing the transition of a specific new employee replacing a departing employee. Succession planning may take the form of assigning a current employee to job shadow the position to be vacated for a certain period before taking over the position, or hiring a new employee to be the "second-in-command" for a certain period before the actual turnover [14]. Succession planning can facilitate the transfer of tacit knowledge and attempts to ensure that knowledge important to a job position is not lost when employees leave. In this way, it is a more directed approach towards addressing knowledge degradation during turnover as compared to job enlargement.

In an opinion survey, manufacturing project managers identified succession from within a team as a preferred approach to minimize the impact of manager turnover [18]. However, it was also noted that even if a project team had the luxury of a handover period from the departing manager, the knowledge that needs to be transferred might be too

voluminous and complex to transfer [18]. With mixed views on the subject, it is useful to examine the effectiveness of succession planning in mitigating the impact of turnover.

3. Proposed Model and Hypotheses

As per human capital theory and our literature review in Table 1, turnover is posited to have a negative impact on ISD project performance. Further, we hypothesize that adopting practices for reducing knowledge degradation i.e., job enlargement, use of electronic knowledge repositories, and succession planning (identified above), can mitigate the negative impact of turnover as per organizational forgetting theory [16]. In addition, we control for the effects of project complexity [51], novelty [52], duration, team size [53], and project manager's tenure on project performance (see Figure 1). The hypotheses are detailed next.

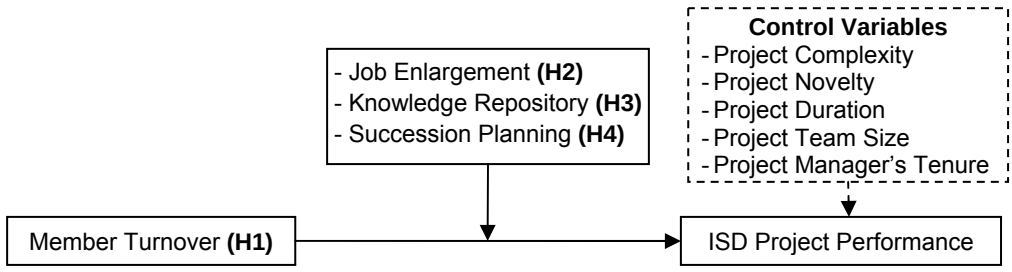


Figure 1. Proposed Model of ISD Team Member Turnover Impact

We hypothesize that turnover negatively impacts ISD project performance, which refers to both efficiency and effectiveness of a project [54]. Efficiency indicates the extent to which a project is completed on schedule and within budget while effectiveness relates to the quality of the resultant IS. The human capital theory suggests that turnover drains human capital in terms of knowledge and skills, reduces productivity, and therefore hurts performance [33]. The hiring and training of replacements also stretch budgets and delay progress [25]. Even if replacements are hired promptly, it takes time for them to understand a project's history and catch up and they may be more prone to err [25]. These issues are likely to decrease a team's productivity and harm the quality of the resultant system. In line with these arguments and our literature review in Table 1 we expect that

H1: The extent of member turnover is negatively related to ISD project performance.

We posit that the negative impact of turnover could be mitigated by practicing job enlargement. The organizational forgetting theory advocates that knowledge degradation accompanying turnover can be reduced by adopting knowledge retention practices [16]. We propose that job enlargement is one such practice facilitating knowledge retention on a continual basis. Job enlargement practices such as rotating tasks could enhance members' awareness of knowledge and skills in other functional areas [42]. Specifically, Patnayakuni et al. [43] suggest that rotating tasks among members in an ISD project could facilitate the sharing of tacit, especially context-specific, knowledge. This can create knowledge redundancy [44] and thereby reduce dependency on specific individuals for knowledge [39]. When turnover (especially unexpected turnover) occurs, the knowledge redundancy allows other members to temporarily cover in part the departing members' work until the vacancy is filled and reduce productivity disruption from turnover.

H2: The negative effect of member turnover on ISD project performance is weakened by the extent of job enlargement in the team.

While job enlargement facilitates the transfer of tacit knowledge, electronic knowledge repositories serve as a form of supra-individual memory that supports the ongoing codification, storage, transfer, and reuse of explicit knowledge [46]. The organizational forgetting theory suggests that it is helpful to adopt practices that prevent the loss of established knowledge [16]. Electronic repositories are likely to be especially effective for storing established, well-understood knowledge that is often more tenable to codification and documentation. Case studies and simulations have reported that a repository facilitates the retention of knowledge in a project's memory when members leave [55] and increase in turnover has little effect on codified knowledge [38]. Not only can a knowledge repository provide efficient access to explicit knowledge related to the work of the departing member, it can also assist the succeeding member in self-learning the past history of a project. This helps

the succeeding member familiarize and become a productive member faster. Therefore, a team that uses knowledge repository extensively is likely to experience less delay in schedule, decrease in productivity, and impairment of outcome quality due to turnover.

H3: The negative effect of member turnover on ISD project performance is weakened by the extent of use of knowledge repository in the team.

Succession planning refers to the practice of identifying and preparing a successor to assume a specific job role that is expected to be vacated [50]. Unlike job enlargement and the use of electronic repositories, which are typically carried out on a continual basis, succession planning focuses on the transition of specific turnovers and is directed at retaining knowledge important for specific job positions. This deliberate endeavor directly addresses the need to minimize knowledge degradation when turnover occurs, as explicated by the organizational forgetting theory [16]. Succession planning provides opportunities for a successor to acquire the ability necessary to take over a particular position and ensure continuity [14]. It allows the successor to learn knowledge relevant to a job position through rich interpersonal interactions, especially tacit knowledge [56]. The focus on transferring knowledge germane to a position helps the successor become familiar with the job responsibilities faster, and avoid repeating past mistakes or reinventing solutions. These are likely to lessen the loss of productivity and quality when actual turnover occurs.

H4: The negative effect of member turnover on ISD project performance is weakened by the extent of succession planning in the team.

4. Research Methodology

The proposed model was assessed with data collected through a survey. This section discusses the development of the survey instrument and the procedure for collecting data.

4.1 Construct Operationalization

Constructs in the model were operationalized with scales validated in prior studies as far as possible. Specifically, items measuring member turnover, ISD project performance, and use

of electronic knowledge repositories were adapted from prior studies. For the constructs of job enlargement and succession planning, new items were developed based on their conceptual definitions (see Table 2). As per Ferratt et al. [57], *member turnover* was measured as the number of members who had voluntarily departed as a proportion of the total number of members involved in an ISD project. Since the focus of this study is on external turnover, respondents were specifically requested to indicate the number of voluntary external turnovers and exclude internal turnovers in the questionnaire.

Table 2. Survey Instrument

Construct and Items[+]	Source
Project Performance (Formative) **PP1:** The project delivered all desired features and functionality; **PP2:** The project met key project objectives and business needs; **PP3:** The project adhered well to its given budget; **PP4:** The project adhered well to its given schedule; **PP5:** The information system had been developed with high quality.	Adapted from Henderson and Lee [53], Tiwana and McLean [13]
Job Enlargement (Reflective) **JE1:** Our team practiced rotation of tasks within members of the project team; **JE2:** Team members were moved around regularly to take over each other's job during the project; **JE3:** Team members were able to take over each other's jobs effectively	Developed based on Hut and Molleman [41]
Knowledge Repository (Reflective) **KR1:** Essential knowledge related to the project was stored in repositories; **KR2*:** Knowledge on the following areas was stored in repositories (tick where applicable): business process/ technical (specifications, initial concepts, prototypes, issue tracking, documentation)/ project (results of project and meetings)/ end user (customer input/reactions); **KR3:** During the project, knowledge needed could be easily accessed from repositories.	Adapted from Choi and Lee [58], Lynn et al. [59]
Succession Planning (Reflective) **SP1:** Second-in-commands were hired in the team for critical roles; **SP2:** Employees were assigned to job shadow key positions; **SP3:** There was grooming of personnel to succeed critical roles in the event of turnover.	Developed based on Stovel and Bontis [14]
Project Complexity (Reflective) **PC1:** The project involved multiple software environments; **PC2:** The project involved multiple technology platforms; **PC3:** The project involved a lot of integration with other systems.	Adapted from Xia and Lee [51]
Project Novelty (Formative) **PN1[#]:** The project used (select one)… a. *Minor* modification of a system design developed in earlier projects; b. *Major* modification of a system design developed in earlier projects; c. Completely new design, but based on concepts already demonstrated in earlier projects; d. Completely new design based on new concepts that have not been demonstrated in earlier projects. **PN2[#]:** The project used (select one)… a. Existing methodology and development tools with *minor* modifications; b. Existing methodology and development tools with *major* modifications; c. Either new methodology or new development tools developed based on existing ones; d. Entirely new methodology and new development tools.	Adapted from Tiwana [52] and Tiwana [60]
[+]All items are scored on a seven-point Likert scale unless otherwise indicated; *Item is scored by the number of applicable options selected by a respondent; [#] Item is scored on a Guttman scale	

For the control variables, items measuring *project complexity* were adapted from an existing scale [51]. *Project team size* and *duration* were measured in terms of the total number of team members involved in a project and months taken to complete a project

respectively [53]. *Project novelty* was measured as a formative construct in terms of process novelty and concept novelty with Guttman scales adapted from Tiwana [52], [60]. For example, a respondent who agreed with the first three items measuring project novelty (i.e., PN1a to PN1c) was considered to be working on a less novel project than a respondent who agreed with all four items (i.e., PN1a to PN1d). *Project manager's tenure* was measured in terms of the number of years a manager had worked in the position.

In data analysis, it is important to clearly distinguish between reflective and formative constructs to avoid biasing the structural model [61]. A reflective construct has observed indicators that are affected by an underlying latent, unobservable construct. Changes in the underlying construct are expected to cause changes in the indicators and the indicators are therefore expected to covary [61]. In contrast, a formative construct is a composite of multiple indicators. Each indicator captures a different aspect of the construct and they need not covary [61]. In this study, project performance and project novelty are considered to be formative constructs. For example, project novelty is composed of process novelty and concept novelty, which do not covary as shown in prior studies [e.g., 60].

To initially assess the proposed survey instrument and identify any necessary refinements, a pretest using the unlabeled and labeled sorting procedures proposed by Moore and Benbasat [62] was conducted. Comments about the clarity of questions were also sought. Results were satisfactory, with inter-judge raw agreement scores averaging 0.88, Kappa scores averaging 0.91, and placement of items within the targeted constructs averaging 0.91.

4.2 Data Collection and Descriptive Statistics

The unit of analysis of this study is the ISD project team. Project managers served as the key informants as they are likely to be knowledgeable about the extent of turnover and the extent to which job enlargement, the use of knowledge repository, and succession planning were practiced. To identify managers for our survey, we contacted members of an IT professional

association (i.e., IT Management Association) and IT professionals studying in a part-time Master's program at a large public university. We also compiled a list of firms providing ISD services by searching an internet-based business directory and called the firms to speak with potential ISD project managers. We invited the managers to answer the survey based on a particular ISD project completed within the past two years, considering that information about recent projects is likely to be easier to recall. A summary of the study's findings was offered as an incentive for participation. A total of 300 managers were approached and 138 of them completed the questionnaire, yielding a response rate of 46 percent.

Descriptive statistics for the final sample are shown in Table 3. As per our sampling, most teams were working in the computer industry (58.7 percent) and consisted of less than ten members (70.3 percent). The most common methodology used was the waterfall approach (62.3 percent). Most projects were completed within 13 to 18 months (29.7 percent).

Table 3. Demographic Statistics (N=138)

Characteristic	Frequency	Percentage*	Characteristic	Frequency	Percentage*
Industry Sector			***Project Team Size***		
Banking and Finance	6	4.3	Less than 10	97	70.3
Computer Industry	81	58.7	10 to 19	23	16.7
Defense	4	2.9	20 to 29	7	5.1
Education	15	10.9	30 to 60	5	3.6
Electronics	2	1.4	More than 60	6	4.3
Logistics	4	2.9	***Project Duration***		
Manufacturing	8	5.8	< 6 months	34	24.6
Medical	2	1.4	6 to 12 months	32	23.2
Research & Development	2	1.4	13 to 18 months	41	29.7
Semiconductor	3	2.2	19 to 24 months	7	5.1
Telecommunications	7	5.1	25 to 36 months	15	10.9
Transportation	4	2.9	37 to 48 months	4	2.9
Project Methodology			49 to 60 months	2	1.4
Agile	25	18.1	> 60 months	3	2.2
Big Bang Approach	3	2.2	*Sum of percentages may not be 100 due to rounding		
Iterative	15	10.9			
Prototyping	9	6.5			
Waterfall	86	62.3			

5. Data Analysis and Results

The model was tested using Partial Least Squares (PLS) analysis with SmartPLS version 2.0 [63]. PLS is appropriate for our analysis because it is able to account for formative constructs (i.e., project novelty and project performance in this study) [72]. PLS is also less affected by

errors in modeling and measurement [72]. This is desirable since this study is an initial attempt to model the moderating effects of job enlargement, use of knowledge repository, and succession planning, with new measures for job enlargement and succession planning. Further, PLS focuses on making predictions rather than fitting model with data [72]. This is in line with our approach of predicting the influence of turnover on project performance moderated by several knowledge retention practices.

5.1 Tests of Measurement Model

The measurement model was evaluated by examining the reliability, convergent validity, and discriminant validity of each multi-item reflective scale [61]. The formative scales were assessed by examining the significance of item weights and item multi-collinearity [61]. For the reflective constructs, reliability was assessed by Cronbach's Alpha coefficient and composite reliability (see Table 4). All the constructs achieved scores above the recommended value of 0.70 for these tests [61]. Convergent validity was assessed with item loading and average variance extracted (AVE). All item loadings were significant at 0.001 level and all AVEs exceeded 0.5, showing satisfactory convergent validity [61].

Table 4. Psychometric Properties of Reflective and Formative Constructs

Reflective Construct	Item	Loading*	Formative Construct	Item	Weight#	VIF
Job Enlargement (JE) α=0.83; CR=0.92; AVE=0.81	JE1	0.90	Project Performance (PP)	PP1	0.30	1.93
	JE2	0.91		PP2	0.17	1.90
	JE3	0.94		PP3	0.25	2.23
Knowledge Repository (KR) α=0.83; CR=0.88; AVE=0.74	KR1	0.91		PP4	0.21	1.85
	KR2	0.81		PP5	0.36	1.61
	KR3	0.90	Project Novelty (PN)	PN1	0.41	2.62
Succession Planning (SP) α=0.77; CR=0.83; AVE=0.72	SP1	0.85		PN2	0.30	2.91
	SP2	0.83	α: Cronbach's Alpha; CR: Composite Reliability; AVE: Average Variance Extracted; VIF: Variance Inflation Factor; * All item loadings were significant at p<0.001; # All item weights were significant at p<0.05			
	SP3	0.89				
Project Complexity (PC) α=0.81; CR=0.76; AVE=0.53	PC1	0.91				
	PC2	0.74				
	PC3	0.74				

Discriminant validity was assessed with factor analysis and comparison of AVEs to construct correlations. Results of factor analysis were favorable as all items loaded highly on their stipulated constructs but not highly on other constructs. Comparison of AVE to construct correlations indicated that none of the construct correlations (non-diagonal entries

in Table 5) exceeded the corresponding square root of AVE (diagonal entries). Overall, discriminant validity was satisfactory.

Table 5. Range, Mean, Standard Deviation, and Correlation among Constructs

	MIN	MAX	Mean	SD	MT	JE	KR	SP	PP	PC	PN	PD	TS	PT
MT^{+} (proportion)	0.05	0.83	0.23	0.25	N.A.									
JE	1	7	3.73	1.51	0.08	**0.90**								
KR	1	7	4.47	1.12	0.07	0.25*	**0.86**							
SP	1	7	4.08	1.30	0.10	0.33*	0.40*	**0.84**						
PP	1	7	4.77	1.37	-0.19	0.11	0.36*	0.35*	N.A.					
PC	1	7	3.88	1.69	0.04	0.11	0.13	0.26*	0.05	**0.73**				
PN	1	7	3.77	0.26	0.02	0.09	-0.08	0.20*	-0.11	0.03	N.A.			
PD^{+} (month)	1	121	17.97	15.80	0.15	-0.10	0.14	0.06	-0.10	0.08	0.03	N.A.		
TS^{+} (person)	4	70	17.74	48.45	0.55	0.09	0.11	0.18*	0.20*	0.02	0.05	0.27*	N.A.	
PT^{+} (year)	1	13	4.21	2.93	0.03	0.09	0.02	0.04	0.07	0.02	0.00	0.10	0.05	N.A.

SD: Standard Deviation; MIN: Minimum; MAX: Maximum
Figures in bold diagonal are square root of AVE;
* Correlation is significant at $p<0.05$.
+ Square root of AVE was not calculated for constructs measured with a single item.

For the formative constructs of project performance and project novelty, significance of item weights was examined to determine the contribution of items constituting the construct. The results were favorable, with all item weights significant at $p<0.05$. Multi-collinearity between two items was assessed through calculating variance inflation factor (VIF). All VIFs were below the recommended threshold of 3.33 [61]. The degree of multi-collinearity among all exogenous constructs was also assessed by calculating the VIF. All VIF values were found to be below the suggested threshold of 3.33. Therefore, we concluded that undesirable multi-collinearity among constructs was unlikely.

As all measures were obtained from the project manager, the possibility of common method bias was examined. Craighead et al. [64] suggest that it is ideal to combine 1) the statistical assessment of Harman's one-factor test with the confirmatory factor analysis (CFA) setting and 2) a methodological, psychological, or temporal separation strategy. This study combines the statistical assessment with a methodological strategy and other strategies suggested by Podsakoff et al. [65]. In the one-factor test, common method bias poses a serious threat if a single latent factor accounts for all manifest variables [64]. A worse fit for

the one-factor model would suggest that common method bias is not significant. We assessed fit with the goodness-of-fit (GOF) measure for PLS [66]. The one-factor model had considerably worst fit than the multi-factor model ($GOF_{one\text{-}factor}$=0.34 vs. $GOF_{multi\text{-}factor}$=0.50), indicating that common method bias was not a threat. In addition, as suggested by Podsakoff et al. [65], a methodological strategy and two other strategies were used to control common method bias. First, the independent and dependent variables were measured with different response formats. Specifically, the independent variable of turnover was measured with an open-ended question on the number of members leaving a project team, while the dependent variable of project performance was measured with Likert scales. Second, survey questions were improved through a pretest to reduce item ambiguity. The survey questions were also measured using only positive values rather than bipolar values (e.g., -3 to +3) to avoid acquiescence bias. Third, respondents were assured of their anonymity and instructed to select the responses that best described their projects rather than the "correct" response.

5.2 Tests of Structural Model

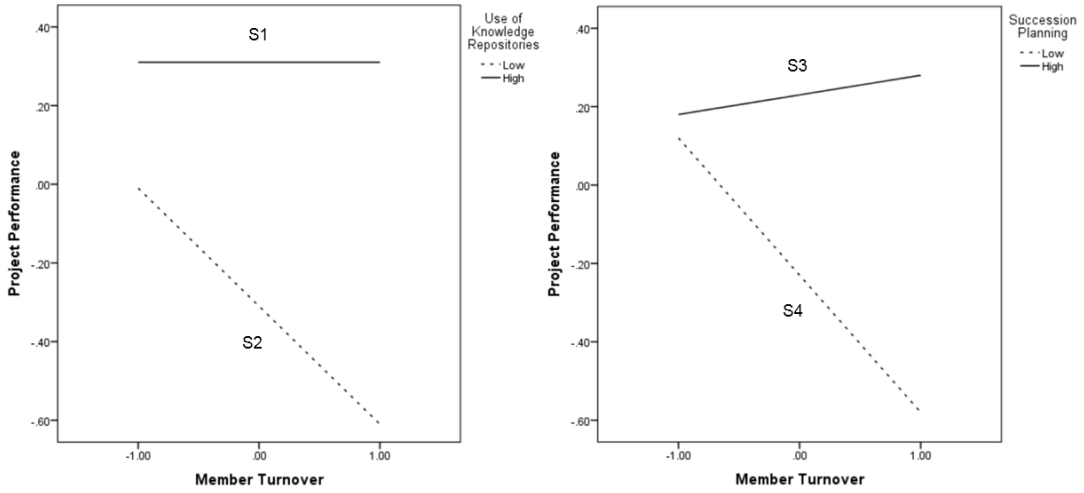
The hypotheses were assessed by testing the structural model. The control variables were entered in the first step, followed by the remaining variables in the next step, and the interaction terms in the final step. The single-indicator approach suggested by Henseler and Fassott [67] was used to analyze the interaction terms. To compute an interaction term, all indicators were mean centered and the model without interaction effects was first analyzed to obtain latent variables scores. The latent variable score of turnover was then multiplied with the latent variable score of the moderating variable to form the indicator for the interaction term (i.e., each interaction term had one indicator).

As shown in Table 6, we found that turnover negatively influenced ISD project performance (i.e., H1 is supported). The negative effect was significantly weaker in teams that used knowledge repositories and succession planning more extensively (i.e., H3 and H4

are supported). However, the practice of job enlargement did not significantly moderate the negative impact of turnover (i.e., H2 is not supported). In addition, we observed that the use of knowledge repositories also had a significant direct effect on project performance. Among the control variables, team size significantly influenced ISD project performance. The model with interaction effects explained 32 percent of the variance in ISD project performance.

Table 6. Results of PLS Analysis

Constructs	Step 1 Control Variables	Step 2 Main Effects	Step 3 Interaction Terms
Project Complexity (PC) Project Novelty (PN) Project Duration (PD) Team Size (TS) Project Manager's Tenure (PT)	0.19 -0.15 0.11 0.15* 0.07	0.14 -0.10 0.04 0.13* 0.06	0.14 -0.12 0.02 0.15* 0.08
Member Turnover (MT) Job Enlargement (JE) Knowledge Repository (KR) Succession Planning (SP)		-0.14* (H1 supported) -0.08 0.31** 0.25*	-0.15* 0.10 0.31** 0.22
MT*JE MT*KR MT*SP			0.01 (H2 not supported) 0.15* (H3 supported) 0.20* (H4 supported)
R^2	0.15	0.28	0.32
*p<0.05; **p<0.01			



* Plotted by substituting into the regression equation the value of -1 (i.e., one standard deviation from the mean) for low succession planning/use of knowledge repositories/turnover and the value of +1 for high succession planning/use of knowledge repositories/turnover; Slopes S1 (p=0.39) and S3 (p=0.15) are insignificant, while slopes S2 (p<0.001) and S4 (p<0.001) are significant.

Figure 2. Mitigating Effects of Knowledge Retention Practices*

As shown in Figure 2, teams that use knowledge repositories and carry out succession planning extensively have better performance in response to turnover. Teams that carry out

these practices do not experience decrease in project performance as turnover increases (i.e., slopes S1 and S3 in Figure 2 are not significant at $p<0.05$). In contrast, the performance of teams that have low use of knowledge repositories and succession planning deteriorates rapidly as turnover increases (i.e., slopes S2 and S4 are significant at $p<0.001$). These show that use of knowledge repositories and succession planning significantly mitigated the negative impact of turnover, as hypothesized.

As discussed earlier, some studies have suggested that turnover has an exponential effect on project performance [39]. It has also been proposed that turnover may have an inverted U-shaped effect on performance considering that low to moderate turnover can revitalize workforce innovation, flexibility, and adaptability [33]. As a post-hoc analysis, we assessed whether the effect of turnover indeed followed a linear model as we hypothesized or an exponential or inverted U-shaped model. Specifically, the following models were tested:

Inverted u-shaped: $y = a + b_1x + b_2x^2$; Exponential: $y = a + b_3^x$; Linear: $y = a + b_4x$

The latent variable score of project performance was used since it is a formative construct [67]. Team member turnover was mean-centered when computing the non-linear terms to reduce non-essential collinearity. We found that collinearity was unlikely, with all VIFs below 3.33. The results (see Table 7) indicated that the inverted U-shaped and exponential effects were not significant (i.e., b_2 and b_3 were not significant), whereas the linear effect is significant (i.e., b_4 was significant). This suggests that our linear model is adequate.

Table 7. Effect of Turnover on ISD Project Performance (PP)

Model of Turnover	Standardized Coefficient	P-Value	VIF	Standardized Coefficient	P-Value	VIF
Inverted U-Shaped (r^2=0.18)	b_1=-0.23*	0.04	1.51	b_2=-0.08	0.55	1.24
Exponential (r^2=0.16)	b_3=-0.17	0.07	1.00			
Linear (r^2=0.18)	b_4=-0.19*	0.03	1.00			
*Path coefficient is significant at p<0.05						

To further ascertain the robustness of our findings, we assessed whether turnover increases

job enlargement, succession planning, or use of electronic knowledge repositories (i.e., the practices are mediators rather than moderators). In favor of the earlier findings, we found that turnover did not influence these practices.

6. Discussion and Implications

The objective of this study was to model and validate practices that can mitigate the negative impact of turnover on ISD project performance. As per our theoretical foundations and literature review we examined job enlargement, use of electronic knowledge repositories, succession planning as potential mitigating practices. As hypothesized the use of knowledge repositories and succession planning were significant in alleviating the detrimental effect of ISD member turnover.

However, we found that job enlargement did not have a significant mitigating effect. This may be due to the costs of implementing job enlargement. It has been observed that job enlargement may decrease efficiency as employees overcome the initial learning curve [42]. While job enlargement can facilitate the distribution of tacit knowledge among members in the long term, it is important to "balance developing people with getting the work done" [42, p. 1524]. Most of the teams in our sample were small with less than ten members and had rather short project duration (13 to 18 months). In such teams, resources are likely to be limited. Any performance benefits offered by job enlargement in reducing knowledge degradation might be offset by the time and costs incurred. Larger teams working on longer-term projects could be examined in future to better ascertain the effect of job enlargement. Nevertheless, this study offers important implications for theory and practice.

6.1 Implications for Research

This study contributes to ISD and turnover research in three significant ways. First, this study adds to the ISD turnover literature that has mainly focused on the antecedents of member turnover in ISD projects, with the remaining studies examining the impacts of turnover. This

is revealed through Joseph et al.'s study [20] as well as our review of the subsequent ISD turnover literature presented earlier. As turnover persistently plagues ISD projects, this study is valuable and novel in modeling and validating practices that can mitigate the negative impact of turnover on ISD project performance.

In a related manner, this study extends research on turnover by drawing attention to the management of turnover. Although researchers have suggested the need to look beyond the antecedents of turnover [9, 31], studies other than the prevention focus have been scarce, as shown in our literature review. We believe that the management of turnover is at least as important as its prevention, considering that turnover cannot be eliminated in practice and continues to prevail across project teams, organizations, and industries. Thus, it becomes necessary to examine how its negative impact can be actively mitigated. Such a "management" focus can complement the extant "prevention" focus to depict a more holistic theoretical view of turnover. Thus, this study contributes through its management focus and provides initial evidence for the utility of this perspective.

Second the study draws and builds on the human capital and organizational forgetting theories to examine the practices for alleviating the negative effect of ISD turnover. While the human capital theory has mainly been employed in previous turnover research to explain the negative linear impact of turnover on performance [15, 33], this study applies it to the ISD context and further shows how the detrimental impact of turnover can be mitigated. For this purpose it makes use of and extends concepts from organizational forgetting theory [16], which proposes the need for knowledge retention activities to prevent knowledge degradation during turnover. Specifically, we identify and validate two practices i.e., use of electronic repositories and succession planning, that are effective for this purpose.

Third, this study contributes to ISD research methodologically by developing and validating operationalizations of job enlargement and succession planning so that they can be

adequately measured in future studies. Further, we measured actual turnover rather than using the proxy measure of individuals' turnover intention. This allowed us to avoid making assumptions about the predictive validity of turnover intention and examine the issue more directly. We also measured team-level turnover. This adds to research by providing evidence for the effect of aggregated turnover on performance, which has been understudied [31].

Overall, this study is more than an attempt to fill gaps in the turnover literature. It demonstrates how theoretically grounded research can be directed to offer insights for dealing with pragmatic challenges facing ISD project managers as described next.

6.2 Implications for Practice

Although turnover cannot be totally avoided, this study showed that its negative impact can be mitigated. First, knowledge repositories can be used to retain knowledge and reduce disruptions due to turnover by ensuring that explicit knowledge remains accessible. Content in the knowledge repository is likely to be more complete when it is utilized from the start of a project. It is important to ensure that critical project knowledge such as those related to system design, project progress, business processes, and end user requirements and feedback is regularly captured and updated as part of the workflow. For example, at Infosys Technologies, a global software services company, knowledge repositories were used to house general technical knowledge for projects as well as project-specific knowledge [68]. To facilitate retrieval of knowledge from the repositories, taxonomies were created to categorize content and automatic classification tools were used to improve the efficiency and accuracy of search engines.

Second, succession planning can help to retain knowledge in specific turnovers. Successors should be selected as soon as a position is expected to be vacated. To facilitate succession planning, key members' job requirements and competencies can be documented to allow timely identification of suitable successors [69]. Second-in-commands may also be

hired for critical positions to support and take over when necessary. It is also important to keep track of the progress and effectiveness of a transition through regular reviews [69].

6.3 Limitations and Future Research

The findings should be interpreted in light of several limitations. First, project managers were the key informants. They were considered appropriate in that they were "insiders" occupying managerial positions and were therefore more suitable to provide information about turnover and team practices. However, future studies could survey other team members for greater reliability. Second, our data were collected in a cross-sectional survey. The causal validity of the model could be further established through longitudinal studies. Last, it was not feasible to conduct random sampling because a comprehensive listing of ISD projects was not available. Instead, we statistically controlled for the confounding effects of several project characteristics that may influence project performance.

There are several potential avenues to extend this research beyond addressing its limitations. First, as per the social capital view described earlier, practices for maintaining social capital when turnover occurs may be examined. Turnover could disrupt knowledge flow by creating structural holes in social communication networks [56]. Since ISD requires the coordination of knowledge and cooperation among members, practices that focus on nurturing social capital could be beneficial. In future, practices such as regular social gatherings, informal water cooler breaks, and setting up social networking sites, could be assessed for this purpose. It could also be useful to model the multi-level effects of individuals' turnover on teams' social capital and project performance. Here turnover can be characterized in terms of departing individuals' job role, tenure, and social network position.

Second, future studies can further examine the use of knowledge repositories and design of succession planning, both of which are found to be effective in mitigating the negative impact of turnover. Potential topics include understanding the factors motivating

ISD project members' continual and high-quality contribution to knowledge repositories, capture and organization of ISD knowledge in repositories, factors motivating predecessors' transfer of knowledge in succession planning, selection of the knowledge to transfer, and factors affecting successors' learning and acceptance of knowledge.

Third, we found that job enlargement, which is a practice for retaining tacit knowledge, was not effective. Future studies can examine other practices such as communities of practice and peer coaching (i.e., members take turn to plan and develop instructional lessons for one another) to identify those that can retain knowledge effectively.

7. Conclusion

As turnover continues to present challenges to the management and success of ISD projects, there is a practical need to minimize both the occurrence and negative impact of turnover. While understanding of the causes of IT professionals' turnover intention has received much research attention, how the impact of turnover can be mitigated remains relatively unclear. Since turnover in ISD projects is not completely avoidable, management of turnover is at least as important as its prevention. This study attempts to bridge such theoretical and practical needs. It builds on the theories of human capital and organizational forgetting as well as prior research to model and assess practices that effectively mitigate the negative impact of turnover on ISD project performance. Such a focus on the management of ISD turnover can complement existing research to enhance our understanding of the phenomenon.

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APPENDIX A: Review of Studies (After 2005) on IT Professionals' Turnover Intention and Actual Turnover

Antecedents of Turnover Intention[#]	Definition	Positive Effect*	Negative Effect*	Insignificant Effect*
Desire to Move				
Affective Commitment	An alignment that employees feel between their organization and their personal value systems and desires [70]		3 [23, 70, 71]	
Continuance Commitment	A state whereby employees are bound to their organization to the extent they "have to be" due to the benefits associated with staying versus the personal costs associated with leaving [70]		2 [70, 71]	
Job Satisfaction	Affective attachment to a job [20]		7 [22-24, 72-75]	1 [76]
Normative Commitment*	Commitment based on a moral belief or obligation that "it is the right and moral thing" to remain with the organization [70]		1 [70]	
Organizational Commitment/ Organizational Identification	The extent to which one is involved in, and identifies with, one's organization [77]		3 [70, 77, 78]	1 [79]
Propensity to Stay	An individual's expected employment duration with an employer for which the individual would prefer to work, i.e., an ideal employer [80]		1 [80]	
Demographics				
Age				2 [81, 82]
Gender	(Positive=Female; Negative=Male)	1 [81]		2 [82, 83]
Ease of Movement				
History of Internal/External Turnover*	The extent to which one has changed job to another company or within a company in the last six months [83]	1 [83]		
Perceived Job Alternatives	The availability of alternative jobs [82]	1 [82]		
Utility of Alternative Jobs*	Individual's valuation of the rewards offered by different alternatives and his appraisal of his chances of being able to realize each alternative			1 [76]
Job-Related Factors				
Emotional Dissonance*	The felt conflict between the way one feels toward interaction partners and the emotion one feels compelled to display toward those individuals.			1 [22]
Job Autonomy/ Decision Control	The degree to which the job provides substantial freedom, independence and discretion in scheduling the work and in determining the procedures to be used in carrying it out [77]		3 [23, 71, 77]	2 [22, 73]
Job Embeddedness	The extent to which one has strong links with people or activities, have better fit with jobs and communities, and need to make greater sacrifices if one leaves an organization [84]		1 [85]	

[#]Constructs are classified into categories proposed by Joseph et al. [20]; *New constructs that were not included in Joseph et al.'s [20] review
* Number of studies finding positive/negative/insignificant effect

Antecedents of Turnover Intention#	**Definition**	**Positive Effect***	**Negative Effect***	**Insignificant Effect***
Job Meaningfulness*	The extent to which employees believe that their work counts to their workgroup, organization or other referent group [23]			1 [23]
Job Performance/ Performance Management	Performance on various job criteria [20]		1 [72]	1 [79]
Role Ambiguity	Sense of uncertainty about what is expected, how to achieve expectations, or the consequences of job performance [22]	3 [22, 72, 85]		1 [73]
Shock*	An event that jars employees to think seriously about turnover [24]	1 [24]		
Role Clarity*	The degree to which responsibilities and expectations are made clear, thus making it easier for individuals to fulfill their role requirements [82]			1 [82]
Role Conflict	The extent to which employees perceive that a "degree of incongruity or incompatibility in the expectations or requirements communicated to a focal person" is placed on their work [82]	2 [72, 85]		2 [22, 82]
Work Exhaustion	Depletion of emotional and mental energy to meet job demands [86]	7 [22, 72-74, 77, 82, 83]		2 [75, 87]
Work Stress*	Challenges of stress [88]	2 [73, 88]		
Workload/ Perceived Work Overload	The extent to which there is insufficient time to complete work demands [77]	4 [22, 72, 74, 77]		
Work-Family Conflict	-The extent to which role pressures from work, family, significant others, and close friends are mutually incompatible in some respect [77] -Need to care for family members (children, home, spouse) [88]	2 [77, 88]		
Perceived Organizational Factors				
Advancement Opportunities/ Promotability	Perceptions of available opportunities for career growth [82]		2 [72, 82]	2 [73, 89]
Career Plateau/ Challenge	Extent to which job is challenging [20]		1 [89]	
Comfort*	Employee's satisfaction with the working environment, the pressure they are put under and travel to work [89]		1 [89]	
Fairness of Rewards	Perception of equity in rewards allocation [20]		3 [22, 71, 77]	1 [87]
Human Resource Practices/ Organizational Involvement	Organization's processes in managing and developing employees [20]	1 [83]	2 [71, 79]	2 [73, 82]
Information Sharing*	The sharing of information on such things as financial performance, strategy, and operational measures [71]		1 [71]	
Organizational Citizenship Helping Behaviors*	The extent to which employees voluntarily helping others with, or preventing the occurrence of, work-related problems [71]			1 [71]

Antecedents of Turnover Intention[#]	Definition	Positive Effect*	Negative Effect*	Insignificant Effect*
Pay and Rewards Satisfaction	Satisfaction with monetary compensation [82]		4 [73, 79, 83, 89]	2 [23, 82]
Procedural Justice	Perceived equity of processes determining performance outcomes [71]			1 [71]
Recognition*	Nonmonetary rewards through which an organization tangibly signals its appreciation of quality work and achievements [71]		1 [71]	
Resource Availability*	The extent to which an organization has adequate resources [82]			1 [82]
Situational Risk*	Risks related to compensation and employment faced by employees [80]	1 [80]		
Situational Variety*	Opportunities available in an organization for a range of different work experiences and associated skill development [80]		1 [80]	
Social Support/ Resource Adequacy/ Supervisory Support/ Support from Colleagues	Employee's satisfaction with the competence and adequacy of the resources provided, in four different areas: the help information and equipment available to the employee; the levels of authority and responsibility the employee experiences; the competence and helpfulness of colleagues, and the competence, helpfulness and friendliness of the employee's supervisor [89]		4 [72, 73, 83, 89]	
Supervisory Satisfaction*	Employee's satisfaction with management's interaction and supervision [23]		1 [23]	
Workplace Characteristics*	Workers' perceptions of the organization in which they operate, including trust in senior management, information sharing, structural fairness, and job security [83]		1 [75]	
Human Capital				
Education	Attained level of formal training	1 [90]		1 [82]
IT Experience*	Number of years of experience with IT [83]		1 [83]	
Job Qualities*	Qualities, skills needed for job [88]	1 [88]		
Learning Motivation*	Desire to learn the content of training and development activities [87]			1 [87]
Organization Tenure / Time in Position	Length of stay in the organization [20]		2 [81, 90]	3 [75, 82, 83])
Perceived Obsolescence	The degree to which professionals lack the up-to-date knowledge and skills necessary to maintain effective performance in either their current or future work roles [85]			1 [85]

Antecedents of Actual Turnover	Definition	Positive Effect*	Negative Effect*	Insignificant Effect*
Recruitment Sources based on Interpersonal Relationships*	The extent to which organizations rely on networking and employee referrals to recruit new employees [91]		1 [91]	
Recruitment Practices based on Monetary Incentives*	The extent to which organizations offer higher-than-market pay to prospective IT employees to induce them to join and remain with the organization [91]		1 [91]	

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