






RESEARCH ARTICLE

Analyzing the impact of work meaningfulness on turnover intentions and job satisfaction: A self-determination theory perspective

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Abstract

While employees actively seek out workplaces that offer meaningful work experiences, the concept of meaningful work remains notably underexplored within the turnover literature. The present study addresses this gap by examining the role of work meaningfulness among knowledge workers and its direct and indirect effects on turnover intentions and job satisfaction through the lens of self-determination theory. Our findings show significant effects on turnover intentions and job satisfaction, with work meaningfulness emerging as a stronger predictor of job satisfaction, while still contributing to reducing turnover intentions. Most extant literature focuses on sources and ways to enhance work meaningfulness. We contribute to more recent research on its relationship with its outcomes especially the link with turnover intentions, offering insight into a relationship that has produced few, but conflicting, results.

Keywords: work meaningfulness; Self-determination theory; turnover intentions; job satisfaction; knowledge workers

Introduction

Work meaningfulness, understood as the degree to which employees feel work is important, personally significant, worthwhile (Caillier, 2021; Lysova, Allan, Dik, Du, & Steger, 2019; Woods & Sofat, 2013), and contributing positively to society (Bailey, Yeoman, Madden, Thompson, & Kerridge, 2019), has been viewed as a critical psychological state. This state, driven by core job dimensions, has been shown to lead to numerous positive outcomes, including job satisfaction (Steger, Dik, & Duffy, 2012), work motivation (Caillier, 2021), performance (Nikolova & Cnossen, 2020), and employee's intention to stay (Sánchez-Cardona, Vera, & Marrero-Centeno, 2021). It has also been found to enhance beneficial work outcomes (Dechawatanapaisal, 2022) while exhibiting a negative relationship with turnover (Charles-Leija, Castro, Toledo, & Ballesteros-Valdés, 2023; Nikolova & Cnossen, 2020; Scroggins, 2008).

In 2008, a study of employees across various industries found meaningful work to be more strongly related to intentions to leave than job satisfaction (Scroggins, 2008). However, in a review of 100 years of turnover literature, meaningfulness is not mentioned at all; it is the workplace antecedent of job satisfaction that is deemed to play a major role in the turnover intention process (Hom, Lee, Shaw, & Hausknecht, 2017), with a significant and negative correlation with turnover intentions for knowledge workers (Hofaidhllaoui & Chhinzer, 2014; Huang, 2011).

Thus, while companies attempt to provide work that is meaningful and employees search for meaningful jobs (Rigby & Ryan, 2018), researchers emphasize the importance of advancing and refining

the conceptual and theoretical frameworks underpinning the understanding of work meaningfulness (Bailey et al., 2019; Blustein, Lysova, & Duffy, 2023). In reviewing 71 empirical studies on work meaningfulness, the authors concluded that further research is needed to explore the significance of various job design features to enhance our understanding of the relationship between job design and work meaningfulness (Bailey et al., 2019).

Our aim is thus to analyze the relationship between work meaningfulness and both turnover intentions and job satisfaction in a less-studied group, that of knowledge workers, by examining the role of job design and contextual factors. Our setting is an electric commercial vehicle manufacturer, specifically a division that had been experiencing higher turnover. By focusing on a single division at one point in time, we assess the current attitudes and behaviors of the employees in their specific context to offer a predictive model that could be tested in other contexts. We also contribute to the turnover literature, which lacks comprehensive studies investigating the role of meaningful work (Scroggins, 2008), although the recent study of meaningful work and turnover in the context of the COVID-19 pandemic is one of the few exceptions (Heath, Williams, & Luse, 2024).

We also enhance the body of research on job satisfaction, a critical aspect of well-being, by addressing the need for an increased focus on employee well-being amidst changes in the nature and context of work (Guest, 2017). While some research shows that meaningful work has important implications for employee well-being (Allan, Batz-Barbarich, Sterling, & Tay, 2019), scholars lament the scarcity of research regarding this relationship (Bailey et al., 2019). In our current context of knowledge workers, our results suggest that work meaningfulness serves as a more powerful predictor of job satisfaction. Nevertheless, it has a significantly strong negative relationship with turnover intentions. A surprising result concerns both higher levels of turnover intentions and lower job satisfaction among supervisory-level employees. We address this in a later section.

To expand the limited body of research on work meaningfulness that applies self-determination theory (SDT) (Allan, Autin, & Duffy, 2016; Frank Martela et al., 2021; Nikolova & Cnossen, 2020), we utilize SDT as our theoretical framework. The results of a study of working adults in 30 European countries showed that the nonmonetary aspects of work, such as relatedness, autonomy, and competence (which correspond to SDT's basic psychological needs), have a 4.6 times stronger association with the meaningfulness of work than income, job insecurity, benefits, and working hours (Nikolova & Cnossen, 2020). Researchers have recently encouraged the application of SDT to guide further research on work meaningfulness (Martela et al., 2021; Nikolova & Cnossen, 2020).

The rest of this paper is structured as follows: After this introduction, we briefly describe our theoretical framework, look at the variables of work meaningfulness, job autonomy, job satisfaction, and turnover intentions, and state our hypotheses. We then describe the study population sample and the measures used, followed by the results of the partial least squares structural equation modeling (PLS-SEM) analyses. The study closes with a discussion of its main theoretical and practical implications, limitations, and future lines of research.

Theoretical lens: SDT

SDT is an empirically based theory of human behavior that is concerned with how social-contextual factors support or thwart individual thriving through the satisfaction of the three basic psychological needs for competence, autonomy, and relatedness (Ryan & Deci, 2017). SDT scholars maintain that satisfying these needs is the basis for a meaningful life, that life purposes or goals may not be experienced as meaningful if they do not satisfy basic psychological needs and furthermore, meaning is viewed as an outcome of basic need satisfaction (Ryan & Deci, 2017). We propose that the same principles apply to work meaningfulness.

Scholars maintain that individuals must satisfy these basic needs to develop and function optimally (Deci & Ryan, 2011). The primary focus of SDT is the individual and how factors such as work context and management style support or hamper the individual's motivation and well-being

(Rigby & Ryan, 2018). SDT proposes that a positive work environment (Trépanier, Forest, Fernet, & Stress, 2015) and the social environment (Grouzet, Vallerand, Thill, & Provencher, 2004) advance well-being by satisfying these psychological needs, thus ensuring autonomous work motivation. Within SDT, meaning is considered an outcome of the natural inherent growth processes of intrinsic motivation.

Although Person-Environment Fit theory is similar in that an individual's thriving is contingent upon the degree of congruence between personal attributes and contextual factors, SDT provides explanatory mechanisms for this type of fit on well-being and other positive individual-level outcomes (Greguras, Diefendorff, Carpenter, & Troster, 2015). Experts argue that trait-based fit is not a sufficient condition for meaningful work (Lysova et al., 2019). Furthermore, researchers emphasize that, according to SDT, not only is a minimum level of motivation necessary to derive any utility from meaning, but the satisfaction of the three basic psychological needs also nurtures and maintains meaningfulness (Nikolova & Cnossen, 2020; Ryan & Deci, 2017). We believe that SDT is better suited as our focus is on human motivation and how well environments can support human psychological needs.

The first of the three needs is competence, which refers to the need to be proficient and effective in one's work, as feelings of effectiveness nourish peoples' selves (Ryan & Deci, 2017). The need for autonomy concerns the extent to which individuals experience their behavior as fully self-endorsed and compatible with their values. Autonomous actions can more fully engage employees' talents, abilities, and energies (Ryan & Deci, 2017). Finally, relatedness concerns feeling connected to others, a sense of belonging, and mutual respect (Deci et al., 2001).

According to SDT, employees have been shown to be healthier, happier, and work harder when efforts to satisfy their basic psychological needs are supported in their place of work (Deci, Olafsen, & Ryan, 2017). The results are higher levels of autonomous motivation, which translates to employee well-being and talent retention, among other positive outcomes (Rigby & Ryan, 2018). SDT suggests that intrinsic motivation can be seen as a process through which individuals create meaning (Ryan & Deci, 2017). The results of a study of employees from a wide range of occupations and industries concluded that being internally motivated at work (resulting from need satisfaction) may be essential to experiencing meaningful work (Allan et al., 2016).

As a number of researchers base their understanding of meaningful work on SDT (Nikolova & Cnossen, 2020) we now turn to the primary variable of interest in our study, work meaningfulness.

Work meaningfulness

Almost half a century ago, researchers proposed the now famous theory of job design (the Job Characteristics Model), which positioned work meaningfulness as a psychological state resulting from the core job design characteristics of skill variety, task identity, task significance, autonomy, and feedback (Hackman & Oldham, 1975).

Decades later, Kahn stressed the importance of meaningful connections at work and identified five dimensions of meaningful connections among employees: task accomplishment, career development, sense-making, provision of meaning, and personal support. He discerned that these dimensions enabled employees to build relationships that met cognitive, relatedness, growth, and other needs (Kahn, 2007). Other researchers have identified a sense of belonging and unity with others as a fundamental element of meaningfulness (Lips-Wiersma & Morris, 2009; Rosso, Dekas, & Wrzesniewski, 2010), which is equitable to SDT's need for relatedness. Making the theoretical connection to SDT, scholars claim that employees cannot benefit from meaning without satisfying the psychological needs of competence, autonomy, and relatedness (Nikolova & Cnossen, 2020).

More recently, meaningful work has attracted much attention among scholars (Bailey et al., 2019, 2019; Lysova, Fletcher, & El Baroudi, 2023) and is considered an important pillar of the work lives of people around the globe (Blustein et al., 2023). However, its conceptualization is trickier; scholars have identified 36 definitions of meaningfulness (Martela & Pessi, 2018). Nevertheless, scholarship

has advanced considerably by bringing to light its multi-dimensionality and presenting a framework that links the individual, job, organizational, and societal dimensions as factors that influence meaningful work (Lysova et al., 2019).

Building upon extant research that identifies job autonomy as a central tenet of work design (Dysvik, Kuvaas, & Gagné, 2013) and its potential to foster motivation and well-being (Väänänen, Toivanen, & Lallukka, 2020) alongside acknowledging its essential role in the effective functioning of knowledge workers (Drucker, 1999), we have selected job autonomy as the independent variable in our model. Notably, in a recent study involving mental health workers, autonomy emerged as a significant predictor of job satisfaction, stress, and turnover intention (Hood & Patton, 2022).

Job autonomy

Job autonomy is the extent to which a job allows freedom, discretion, and independence to schedule work, make decisions, and choose the methods to perform tasks (Humphrey, Nahrgang, & Morgeson, 2007; Van den Broeck, Ferris, Chang, & Rosen, 2016). SDT's equivalent of autonomy, it primarily influences work outcomes via autonomy need satisfaction (Laguerre & Barnes-Farrell, 2024), and is considered an important job resource that may contribute to achieving and sustaining positive individual-level outcomes (Clausen, Pedersen, Andersen, Theorell, & Madsen, 2022). As a resource, job autonomy is also known to protect employees from psychological strain as it allows individuals to control basic aspects of their working conditions, such as organizing their work tasks and scheduling their breaks (Karasek, 1979). It is essential in complex jobs as employees are required to make decisions and exercise judgment (Chung-Yan, 2010).

Redesigning jobs to provide greater autonomy has been demonstrated to benefit employee well-being (Clausen et al., 2022; Guest, 2017), and scholars have found that greater relative autonomy makes companies great places to work (Ryan & Deci, 2017). Providing autonomy support, in turn, facilitates the satisfaction of the needs for competence and relatedness (Ryan & Deci, 2017). SDT researchers emphasize that supporting autonomy in the workplace yields a high level of motivation, which allows employees to employ problem-solving skills and cognitive flexibility more deeply (Gagné & Deci, 2005). Scholars also point to the multidimensionality of autonomy and stress its inherently social and interdependent nature, especially in relation to knowledge work (Väänänen et al., 2020).

As the need for autonomy has also been found to be connected to work meaningfulness (Humphrey et al., 2007; Kubiak, 2020; Martela & Riekkki, 2018; Zheng, Wu, & Graham, 2020) and is a key need in SDT (Karkkola, Kuittinen, & Hintsala, 2019), we propose our first hypothesis:

Hypothesis 1: Job autonomy positively influences work meaningfulness.

Meta-analytic findings have shown that work meaningfulness serves as a mediator in the relationship between job characteristics and numerous outcomes (Parker, 2014), among them job satisfaction (Bailey et al., 2019). Recognizing that employee well-being is key to employee retention, we turn to the concept of job satisfaction.

Job satisfaction

Employee well-being is a broad term and encompasses both physical and psychological health. Here, we focus on the psychological aspect and context-specific well-being, in particular, job satisfaction (Arnold, Turner, Barling, Kelloway, & McKee, 2007). Job satisfaction has been defined as an expression of approval of a work environment (Locke, 1976) and positive feelings about the employee's particular role (Harris, Cooper-Thomas, Smith, & Cheung, 2022). It is considered a positive emotion and serves to buffer the harmful effects of stress (Fredrickson, 2001). Several studies have also revealed a strong negative relationship between job satisfaction and turnover intentions (Chung, Jung, & Sohn, 2017; Jung, 2012; Richer, Blanchard, & Vallerand, 2002).

Recent research points to the continued importance of job satisfaction, and scholars call for an emphasis on its determinants (Judge, Zhang, & Glerum, 2020). Empirical findings support the notion that work meaningfulness enhances job satisfaction (Bailey et al., 2019; Choi et al., 2021).

As job autonomy is an important determinant of well-being (Clausen et al., 2022) and work meaningfulness has been found to predict job satisfaction (Bailey et al., 2019), we present our next hypothesis.

Hypothesis 2: Work meaningfulness positively influences job satisfaction.

In a study of nurses that examined the relationship between workload and job satisfaction, the mediating variable of meaningfulness served as a motivator for the nurses and enhanced their perceived job satisfaction (Al-Hakim, Zhang, Jin, & Sevdalis, 2022). In a time-lagged study of Generation Y knowledge workers who employed job crafting, the variable of work meaningfulness also served as a mediator, improving the likelihood of them staying with the organization (Malik & Malik, 2024).

We predict that job autonomy, as an element of job design and a valuable job resource shown to enhance intrinsic motivation as per SDT (Liu, Jameel Ahmed, Anjum, & Mina, 2024), will foster work meaningfulness and that work meaningfulness, as the examples above illustrate, is crucial for achieving positive individual outcomes such as job satisfaction or the intention to remain with an organization.

Building on our first two hypotheses and following a segmentation approach (Rungtusanatham, Miller, & Boyer, 2014), we propose a hypothesis for the mediation effect of work meaningfulness:

Hypothesis 3: Work meaningfulness positively mediates the relationship between job autonomy and job satisfaction.

While a greater focus on well-being is crucial in its own right, an important benefit of job satisfaction is that it has also been found to reduce turnover, a key concern for companies.

Turnover intentions

An organization is adversely affected when employees intend to leave, whether they finally end up departing or not, as it can decrease their fulfillment of obligations and thus negatively affect their individual and organizational performance (Jung, 2012). When employees do leave, the resulting work disruptions, losses of organizational knowledge, and emotional effects on co-workers can have a strong negative impact on an organization (Ju & Li, 2019).

Both scholars and practitioners have been speculating for decades about the reasons that lead employees to leave organizations and how to prevent production disruption and loss of key employees and organizational memory (Christensen & Knardahl, 2022). The cost of replacing employees has been estimated to be between 90% and 200% of an employee's annual salary (Allen, Bryant, & Vardaman, 2010). Knowledge workers are among the most expensive employees to replace and are vital to a firm's success due to the value of their intellectual capital (Hofaidhllaoui & Chhinzer, 2014).

Turnover intention is important as it predicts actual turnover or the likelihood that someone will leave an organization in the near future (Caillier, 2021). Despite its predictive value, there has been a tendency among scholars to overlook the influence of working conditions on turnover intentions (Christensen & Knardahl, 2022). In a study comparing working adults who graduated in 2008 with those who graduated in 2022, researchers found that the COVID-19 pandemic has prompted individuals to seek meaningful work opportunities in firms that emphasize their health and well-being (Donald, 2023). Interviews with Generation Z professionals point to a sense of purpose at work as the most important driver for their happiness while also placing great importance on a collaborative and inclusive work environment, job autonomy, access to training and development, a competitive salary package, and career progression opportunities (Donald, 2024).

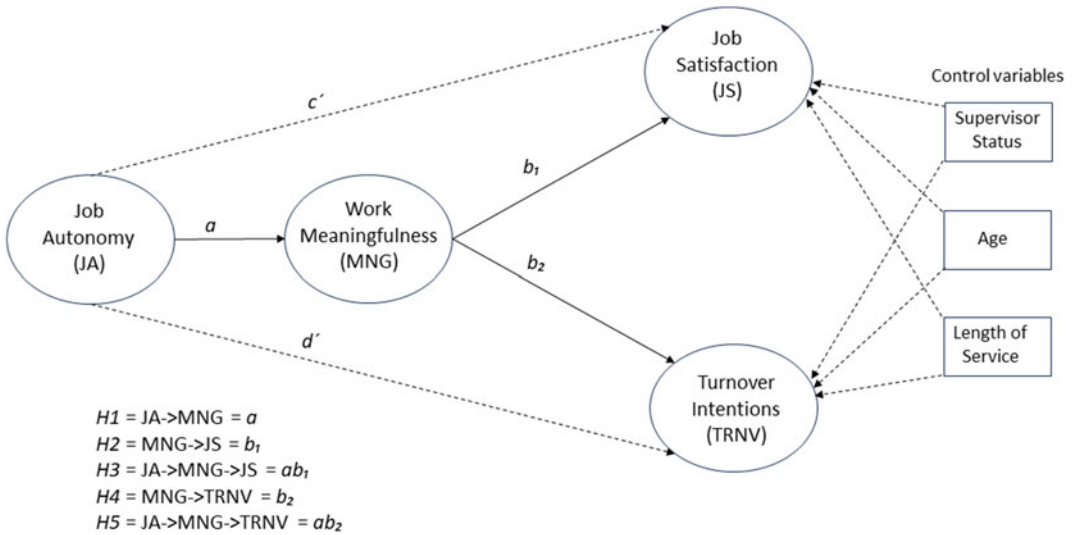


Figure 1. Conceptual model.
 Notes: ———▶ Non-hypothesized relationship

Furthermore, the authors of a 2-year turnover study in Norway encourage researchers to focus less on personal factors and attitudes and more on environmental characteristics that may reduce turnover. The results point to factors such as experiencing clarity and harmony between goals, empowering leadership, and a social climate characterized by high levels of trust, support, and fairness (Christensen & Knardahl, 2022). According to scholars, job characteristics do not directly impact turnover intentions; instead, emotional reactions precede intentions to quit (Agarwal & Gupta, 2018). Given the motivating potential of meaningfulness in employee contexts (Albrecht & Su, 2012), its experience as an affective state that promotes positive emotions (Carton, 2018), and a recent study pointing to meaningful work and its negative influence on turnover intention (Heath et al., 2024), we propose our fourth hypothesis:

Hypothesis 4: Work meaningfulness is negatively related to turnover intentions.

Scholars have demonstrated that work meaningfulness is not a static but rather a continuous state, which involves a deeper level of intrinsic motivation (Malik & Malik, 2024). Other researchers claim that meaningful work can attract and retain talent and sustain employees’ intrinsic motivation (Bailey et al., 2019). We predict that as long as job autonomy enhances work meaningfulness, work meaningfulness will (negatively) impact employee turnover intentions. Thus, we see work meaningfulness as the key to understanding the relationship between job autonomy and turnover intentions.

Building on our first hypothesis regarding the relationship between job autonomy and work meaningfulness, we propose our last hypothesis for the mediating effect of work meaningfulness:

Hypothesis 5: Work meaningfulness negatively mediates the relationship between job autonomy and turnover intentions.

Before viewing our results, let us look at our conceptual model (Figure 1), our setting, and our measurements.

Methodology

Setting and participants

The setting for this study was a division of a commercial electric vehicle manufacturing company in the United States. We were informed that a survey on culture and values had been administered 6 months earlier. The survey results pinpointed several areas that needed attention, among them, insufficient onboarding, a lack of accountability, long working hours, and a sense of confusion regarding individual roles. The company's leadership advised us that a number of people had recently left the company and that a substantial number of new employees had recently been hired.

This particular division of knowledge workers consisted mainly of engineers, although there were also CAD designers, test technicians, test engineers, software developers, technical publishers, and project managers. As work meaningfulness also refers to the context within which the work is performed (Wang & Xu, 2019) and a company that strives to help humanity by providing clean energy solutions would, in our view, be regarded as significant and beneficial, we deemed our choice all the more interesting for this study. Furthermore, this division was not only comprised of engineers but also included employees occupying various roles across three hierarchical tiers (non-supervisory, team leader, and department manager), rendering it not only representative of the organization but also reflective of the broader electric transportation sector.

A brief explanation for the survey ('... to follow up and delve deeper into the results of the previous culture survey') along with a link to the survey on LimeSurvey was sent by email to division managers. The managers then forwarded it to their groups of employees. Although the surveys were voluntary, employees were encouraged to participate to have their voices heard. Several open-ended questions were included for this purpose, to allow the company to implement changes based on employee feedback. Participants were assured of complete anonymity, and only aggregate data was reported back to the company (information regarding gender, age, length of service, and supervisory status was excluded).

Out of a total of 140 employees, 129 answered the surveys. Nine incomplete surveys were excluded, resulting in 120 valid surveys (86% return rate). This high response rate reduced the possibility of selection bias. One executive (the only one holding that position) and two employees who did not specify their supervisor status were excluded from our survey for a total of 117 surveys.

Several recent cross-sectional studies published in top journals (Q1) have successfully used small sample sizes (114 or less) to examine relationships involving psychological need satisfaction or work meaningfulness (Haffer, Haffer, & Morrow, 2021; Hood & Patton, 2022; Karkkola et al., 2019).

Considering the most complex regression in our model is generated by five predictors, we used the G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) tool. Assuming a medium effect size ($f^2 = 0.15$), we conducted a priori analysis to compute the required sample size. As a result, we would initially need a minimum sample of 92 cases to obtain a power of 0.80 and an alpha level of 0.05. Therefore, our sample ($n = 117$) is technically sufficient to test our research model. Furthermore, we performed a post hoc analysis, taking into account our final sample of 117 cases. As a result, our sample allows us to achieve a power level of 0.904 ($\alpha = 0.05, f^2 = 0.15$) and is enough to detect path coefficients with effect sizes (f^2) greater than 0.115 ($\alpha = 0.05, \text{power} = 0.80$).

Table 1 presents the descriptive statistics for the participants.

Measures

The items for each measure (job autonomy, work meaningfulness, job satisfaction, and turnover intentions) were assessed on a 5-point Likert scale, where 1 = *strongly disagree* and 5 = *strongly agree*. As employee perceptions of what is happening to them at work are more accurate predictors of their attitudes, behavior, and well-being than managers' reports (Boxall & Macky, 2014), our level of measurement was the individual employee.

Table 1. Descriptive statistics

		Frequency	Percent
Gender	Male	101	86.3
	Female	16	13.7
Age	18–27	25	21.4
	28–39	52	44.4
	40–49	18	15.4
	50–59	16	13.7
	60+	6	5.1
Tenure	Less than a year	29	24.8
	1–4 years	60	51.3
	5–9 years	19	16.2
	10–14 years	9	7.7
Supervisor status	Non-supervisor	97	82.9
	Team leader/supervisor	14	12.0
	Department/division manager	6	5.1
Education	High school diploma	5	4.3
	Vocational school diploma	4	3.4
	Two/four-year college degree	79	67.5
	Graduate school degree	29	24.8

N = 117.

Job autonomy

JA was measured using a nine-item scale (Morgeson & Humphrey, 2006). A sample item was ‘This job provides me with significant autonomy in making decisions.’

Work meaningfulness

WM was measured using four items from the 2016 Merit Principles Survey. Caillier used the scale in his study on workplace aggression and its impact on work meaningfulness (Caillier, 2021). A sample item was ‘The work I do is meaningful to me.’

Job satisfaction

JS was measured using a three-item job satisfaction scale validated by Bowling and Hammond (2008), and strongly recommended by these authors as a tool for assessing global job satisfaction. The only modification was to convert the third item into a positive question. A sample item included, ‘All in all, I am satisfied with my job.’

Turnover intentions

TRN was measured using a two-item scale adapted from (Colarelli, 1984). A sample item included: ‘I frequently think about quitting my job.’

Control variables

We used age, tenure, and supervisor status to control for potential confounding effects. Age was measured in five 10-year increments, while tenure was divided into four increments. Supervisor status

was measured in three categories: non-supervisor, team leader/supervisor, and department/division manager.

Data analysis

We applied PLS-SEM (Ciavolino, Aria, Cheah, & Roldán, 2022) using Smart PLS version 4 to analyze our data (Ringle, Wende, & Becker, 2022) and the SEMinR package in R (Ray, Danks, & Calero Valdez, 2022) to compute the predictive contribution of the mediator (PCM). Following the guidelines proposed by researchers on the use of PLS-SEM, our choice was based on testing a theoretical framework from a causal-predictive perspective and a relatively small sample of 117 employees (Hair, Risher, & Ringle, 2019). Scholars have also praised the greater statistical power of PLS-SEM (compared to covariance based SEM or CB-SEM) as it increases the likelihood of identifying a statistically significant relationship when one is present in the population (Hair, Hult, Ringle, & Sarstedt, 2022). As our model is based on variables that respond to a common factor model, we used the consistent PLS tool to test our model and the consistent bootstrapping tool. In terms of hypothesis testing, scholars recommend that whenever the common factor model holds, researchers should use consistent PLS over regression on sum scores or traditional PLS (Dijkstra & Henseler, 2015).

Common method bias

Common method bias (CMB) refers to the phenomenon where respondents' answers are influenced by the manner in which questions are asked, meaning the measurement instrument itself affects their responses rather than their actual beliefs or attitudes (Magalhães-Teixeira, Roldán, & Leal Millán, 2024). To prevent the occurrence of CMB, we followed Podsakoff's recommendations during the design of the surveys (Podsakoff, MacKenzie, & Podsakoff, 2012). Additionally, we conducted a collinearity test based on variance inflation factors following the guidelines provided by Kock (Kock & Lynn, 2012). According to the authors, a variance inflation factor value greater than 3.3 in the inner model would indicate pathological collinearity and most likely be affected by common method bias. As the variance inflation factor values in this test ranged between 1.349 and 2.715, the model was deemed to be free of common method bias.

Results

Assessment of the measurement model

Researchers recommend a two-step procedure for PLS-SEM assessment, which begins with evaluating the measurement model, followed by assessing the structural model (Hair et al., 2022). To assess the measurement model, we examined indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. All loadings were generally above 0.70, as recommended by Hair et al. (2022). Cronbach's α , composite reliability, and Rho_a estimates were all above 0.7 and below 0.95, indicating internal consistency reliability (Guenther, Guenther, Ringle, Zaefarian, & Cartwright, 2023). The measures for the average variance extracted supported convergent validity as they were all above 0.5 (Cepeda, Roldán, Sabol, Hair, & Chong, 2024). The results are displayed in Table 2.

To assess discriminant validity, we evaluated the heterotrait–monotrait values as recommended by Franke and Sarstedt (Franke & Sarstedt, 2019). Our results confirmed that all the heterotrait–monotrait values were below the threshold of 0.85 (Table 3), thus establishing discriminant validity (Henseler, Ringle, & Sarstedt, 2015). To further test discriminant validity, we used the Fornell and Larcker criterion (Fornell & Larcker, 1981). Discriminant validity was also supported since the square root of the average variance extracted values was greater than their correlations with the other constructs.

We also applied bootstrap-based saturated model fit tests (standardized root mean square residual [SRMR] and d_{ULS}) for confirmatory factor analysis (Henseler, 2017). The two indicators, which

Table 2. Measurement model results

Construct	Item	Loading	Alpha	rho_A	CR	AVE
Job	JA1	0.966	0.946	0.952	0.945	0.661
autonomy	JA2	0.783				
	JA3	0.844				
	JA4	0.835				
	JA5	0.883				
	JA6	0.693				
	JA7	0.649				
	JA8	0.889				
	JA9	0.720				
Work	MG1	0.888	0.943	0.949	0.944	0.809
meaningfulness	MG2	0.958				
	MG3	0.951				
	MG4	0.792				
Job	JS1	0.934	0.889	0.916	0.897	0.746
satisfaction	JS2	0.690				
	JS3	0.944				
Turnover	TRNVR1	0.963	0.917	0.924	0.919	0.851
intention	TRNVR2	0.880				

CR: composite reliability; AVE: average variance extracted.

Table 3. Discriminant validity

	JA	MNG	JS	TRNV
JA	0.813	<i>0.582</i>	<i>0.479</i>	<i>0.382</i>
MNG	0.58	0.899	<i>0.679</i>	<i>0.466</i>
JS	0.47	0.68	0.864	<i>0.801</i>
TRNV	-0.385	-0.469	-0.781	0.922

JA: job autonomy; MNG: work meaningfulness; JS: job satisfaction; TRNV: turnover intention. The diagonal elements (bold) are the square roots of the average variance extracted (AVE) values. The Fornell–Larcker criterion is in the lower left corner, and the heterotrait–monotrait ratios (HTMT; italics) are in the upper right corner. Off-diagonal lower elements are the correlations between constructs.

measure the difference between the observed correlation matrix and the model-predicted values, were lower than the respective HI95 or HI99 values from the saturated model. This suggests support for our proposed measurement model, as the observed disparity was not significant (Table 4).

Assessment of the structural model

From a causal perspective, we analyzed the overall fit of the hypothesized model to obtain empirical evidence for the research model (Henseler, 2021) (Table 4). The SRMR achieved a value of 0.075, below the standard cut-off of 0.08. Next, we conducted two bootstrap-based tests of the overall model fit (SRMR and d_{ULS}). Our results showed that all discrepancy values were below the 95th or 99th percentile. Consequently, the postulated model cannot be rejected, as it is likely true.

Next, to ensure that our PLS-SEM results were robust, we applied the Gaussian copula approach to test for endogeneity (Hult et al., 2018) to identify potential omitted variables. We focused on our two dependent variables, the most complex regressions of the hypothesized model: MNG and JA

Table 4. Tests of model fit

	Value	HI95	HI99
Saturated model			
SRMR	0.060	0.065	0.074
d_{ULS}	0.838	0.983	1.260
Estimated model			
SRMR	0.075	0.070	0.078
d_{ULS}	1.282	1.118	1.409

SRMR: standardized root mean squared residual; d_{ULS} : unweighted least squares discrepancy; HI95: bootstrap-based 95% percentile; HI99: bootstrap-based 99% percentile.

Table 5. Evaluation of the Gaussian copula approach

Nonnormality test results			
	Cramér–von Mises test statistic		Cramér–von Mises p -value
JA	0.444		0
MNG	0.712		0
Gaussian copula results			
	Coefficient	t -value	p -value
$GC_{JA} \rightarrow JS$	0.118	0.558	.577
$GC_{MNG} \rightarrow JS$	0.268	1.304	.192
$GC_{JA} \rightarrow TRNV$	0.088	0.389	.697
$GC_{MNG} \rightarrow TRNV$	-0.289	1.458	.145

JA: job autonomy; MNG: work meaningfulness; JS: job satisfaction; TRNV: turnover intention; GC: Gaussian copula. p -value based on bootstrapping ($n = 10,000$ subsamples) using a two-tailed test.

regressed to JS, and MNG and JA regressed to TRNV. We tested JA and MNG, which may demonstrate endogeneity, and found that they had a nonnormal distribution. The Cramér–von Mises test indicated that both predecessors were not normally distributed (Table 5). Next, we performed a Gaussian copula analysis in SmartPLS and executed a two-tailed bootstrap analysis of 10,000 samples. None of the four copula terms was statistically significant at the 5% probability of error level, leading us to conclude that our results are unaffected by possible endogeneity concerns (Table 5), mainly due to omitted constructs that could correlate with one or more predictor constructs and both dependent constructs.

Having found evidence to support the research model from a causal point of view, we now assess the basic parameters of the structural model. The first step is to ensure that there are no multicollinearity problems between the antecedent variables of the dependent constructs. To do this, we evaluate the predecessor variables' variance inflation factor values. Since the highest value we found is 1.561, we can confirm that there are no multicollinearity problems in our structural model.

Table 6 and Figure 2 include the key structural parameters of our research model, including the relationships postulated and two nonhypothesized relationships, which are necessary to calculate the mediation effect (Nitzl, Roldán, & Cepeda, 2016; Rasoolimanesh, Wang, Roldán, & Kunasekaran, 2021). We used consistent bootstrapping (10,000 samples) to generate path values and confidence intervals. We first tested the model without the control variables and excluded the nonhypothesized paths. Our path results were similar to those outlined below; only the MNG path was higher before adding the control variables and the nonhypothesized paths (-0.470 vs. -0.389). The R^2 values were the same for MNG (0.338), lower for JS (0.459 vs. 0.558), and lower for TRNV (0.221 vs. 0.425) while remaining statistically significant. Therefore, including our control variables did not significantly alter the results. Furthermore, all the signs of the path coefficients coincided with our hypotheses.

Table 6. Structural model results. Direct effects on endogenous variables

	Direct effect	t-value	p-value	PBCI	Support	Explained variance	f^2	VIF
MNG ($R^2 = 0.337$)								
H1(+): JA (a)	0.580	5.244	.000	[0.386; 0.750]	Yes	33.6%	0.508	1.000
JS ($R^2 = 0.558$)								
H2(+): MNG (b_1)	0.627	5.805	.000	[0.469; 0.827]	Yes	42.6%	0.583	1.524
JA (c')	0.100	0.664	.507	[-0.240; 0.346]		4.7%	0.014	1.561
Supervisor status	-0.228	2.927	.003	[-0.385; -0.080]		5.1%	0.095	1.229
Age	0.123	1.601	.109	[-0.031; 0.267]		1.0%	0.034	1.015
Length of service	-0.084	0.968	.333	[-0.240; 0.096]		2.4%	0.012	1.300
TRNV ($R^2 = 0.425$)								
H4(-): MNG (b_2)	-0.389	2.323	.010	[-0.700; -0.158]	Yes	18.2%	0.173	1.524
JA (d')	-0.112	0.559	.576	[-0.427; 0.329]		4.3%	0.014	1.561
Supervisor status	0.313	3.041	.002	[0.111; 0.511]		11.5%	0.138	1.229
Age	0.072	0.947	.344	[-0.078; 0.221]		0.8%	0.009	1.015
Length of service	0.188	2.155	.031	[0.013; 0.356]		7.7%	0.047	1.300

JA: job autonomy; MNG: work meaningfulness; JS: job satisfaction; TRNV: turnover intentions; VIF: variance inflation factor; PBCI: percentile bootstrap confidence interval. Bootstrapping based on $n = 10,000$ subsamples. The hypothesized effects are evaluated using a one-tailed test for a Student's t distribution (CI 90%). The nonhypothesized effects and those of the control variables are assessed by using a two-tailed test (CI 95%).

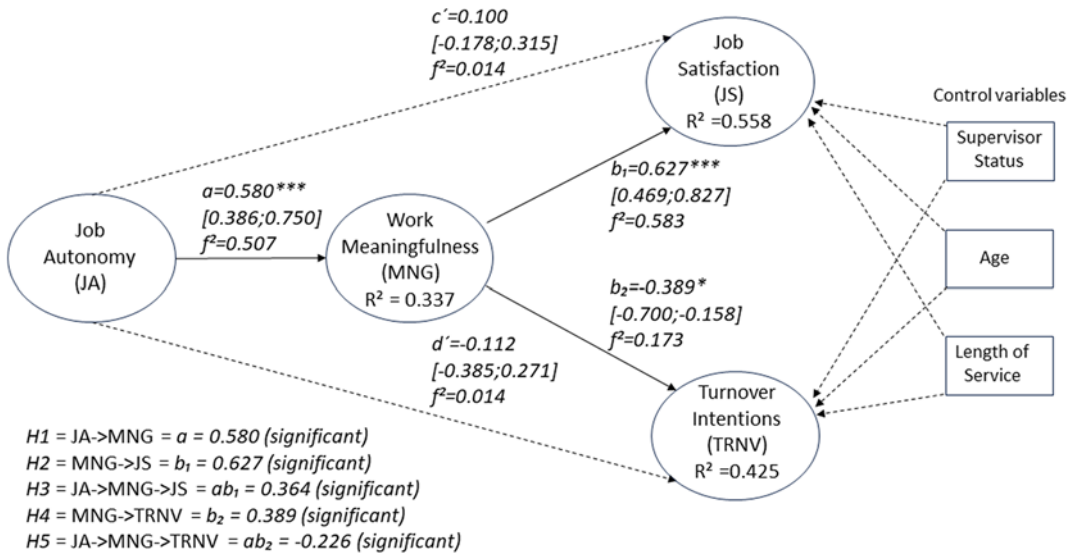


Figure 2. Structural model.

Note(s): * $p < 0.05$, *** $p < 0.001$, ns: non-significant (based on $t(9999)$, one-tailed test) + $p < 0.05$, ns: non-significant (based on $t(9999)$, two-tailed test)

The significance of the paths, as well as the f^2 values and the R^2 values for the dependent variables after testing the model with the control variables and nonhypothesized paths, are shown in Table 6 and Figure 2. The three direct effects were statistically significant. This means that H1(+), H2(+), and H4(−) were supported. Consequently, JA positively influences MNG, while the latter has a positive significant effect on JS and a negative impact on TRNV. Regarding the control variables, as seen in Table 6, supervisor status was statistically significant in predicting both lower job satisfaction and higher turnover intentions. Length of service also had a statistically significant positive effect on turnover intentions. The R^2 values for our endogenous latent variables were moderate for MNG (0.508), JS (0.558), and TRNV (0.425) (Hair et al., 2022). Thus, the R^2 values showed that 42.5% of turnover intention and 55.8% of job satisfaction were explained by our model, indicating a substantial in-sample predictive power. We also assessed the f^2 effect sizes and compared them with the cut-off points of 0.02, 0.15, and 0.35, as suggested by Cohen (1988). We found that the effect size of work meaningfulness on job satisfaction was large ($f^2 = 0.583$), and the effect size of work meaningfulness on turnover intentions was medium ($f^2 = 0.173$).

To assess our model’s predictive performance, we followed the procedure outlined by Shmueli and colleagues and evaluated the out-of-sample predictive power of the model using PLSpredict (Shmueli et al., 2019). We performed k -fold cross-validation with $k = 3$ subgroups to ensure at least 30 cases in each holdout sample. In the first stage, we observed that all Q^2_{predict} values for all indicators of dependent variables were positive (Table 7). In the second step, because the prediction errors were symmetrically distributed, we used the root mean squared error to assess the degree of prediction error. In this case, the root mean squared error PLS values produced smaller prediction errors than the root mean squared error linear model values (Table 7), thus indicating a high level of out-of-sample predictive performance of the model. These results indicate that the research model could yield generalizable findings for other data sets and potentially equivalent contexts.

Finally, we performed the cross-validated predictive ability test (CVPAT) (Sharma, Liengard, Hair, Sarstedt, & Ringle, 2023) using the overall indicator average and the linear model prediction benchmarks to evaluate the predictive accuracy of the model. We began by comparing the average

Table 7. PLS_{predict} assessment of the indicators of dependent variables

	PLS-SEM		LM	PLS-SEM – LM
	Q ² _{predict}	RMSE	RMSE	RMSE
MNG1	0.221	0.828	0.992	-0.164
MNG2	0.260	0.824	0.924	-0.100
MNG3	0.229	0.776	0.855	-0.079
MNG4	0.184	0.755	0.835	-0.080
JS1	0.170	0.779	0.813	-0.034
JS2	0.154	0.721	0.818	-0.097
JS3	0.133	0.755	0.795	-0.040
TRNV1	0.215	0.997	1.048	-0.051
TRNV2	0.158	0.995	1.050	-0.055

LM: linear regression model; RMSE: root mean square error.

Table 8. Cross-validated predictive ability test (CVPAT) results for predictive model assessment

PLS-SEM vs. indicator average (IA)					
	PLS loss	IA loss	Average loss difference	t-value	p-value
Overall model	0.691	0.858	-0.155	3.463	.001
PLS-SEM vs. linear model (LM)					
	PLS loss	LM loss	Average loss difference	t-value	p-value
Overall model	0.691	0.826	-0.135	2.88	.005

loss difference when faced with PLS-SEM predictions versus the naïve indicator average for the overall model. As shown in Table 8, our model had a significant and negative loss difference. Next, we compared the PLS-SEM predictions with the linear model prediction benchmark. The difference was also negative and significant for the overall model. Consequently, from the point of view of the CVPAT analysis, our model has strong predictive validity. This is in line with the conclusions raised by the previous PLS_{predict} analysis. Therefore, our model would produce generalizable results that could be applied to other similar populations.

We analyzed the mediation effects of our research model (Figure 1), adopting a double causal-predictive approach (Cepeda et al., 2024). From an explanatory point of view, we sought to understand how and why JA affects both JS and TRNV through an intervening variable, MNG. We included both direct effects (c' and d') as nonhypothesized relationships to evaluate the mediating effects (Nitzl et al., 2016). We estimated the total, direct, and indirect effects, controlling for the three control variables. Researchers advise using bootstrap results for testing indirect effects directly from the PLS software to avoid fixed measurement issues (Nitzl et al., 2016). Statistical mediation is considered significant when confidence intervals exclude zero. The results of the mediation analyses (Table 9) revealed significant indirect effects for ab_1 and ab_2 . Furthermore, neither direct effect (c' and d') was significant. Therefore, H3(+) and H5(-) were supported, and there was only indirect mediation, which implies that MNG fully mediated the relationships between, on the one hand, JA and JS and, on the other, JA and TRNV. In addition, we estimated effect size measures to assess the magnitude of both indirect effects. We first calculated the variance accounted for (VAF) index (Nitzl et al., 2016), which compares the indirect and direct effects to the total impact. We found that 78.4 % of the influence of JA on JS was due to the indirect effect of MNG. Only 21.6 % was direct. At the same time, 66.9% of the effect of JA on TRNV was indirect. Both results reinforce the mediating role of MNG. Next, we turned to the effect size ν , a metric proposed by Lachowicz, Preacher, & Kelley (2018). The ν

Table 9. Summary of mediating effects test

Total effect on JS	Coefficient	t-value	p-value			
JA (c)	0.464	4.83	0			
Direct effect on JS	Coefficient	t-value	p-value		VAF	
JA (c')	0.1	0.664	.507		21.6%	
Indirect effect on JS	Coefficient	5% PBCI	95% PBCI	Support	VAF	ν
H3(+): ab_1 (via MNG)	0.364	0.218	0.588	Yes	78.4%	0.132
Total effect on TRNV	Coefficient	t-value	p-value			
JA (d)	-0.338	2.986	.003			
Direct effect on TRNV	Coefficient	t-value	p-value		VAF	
JA (d')	-0.112	0.559	.576		33.1%	
Indirect effect on TRNV	Coefficient	5% PBCI	95% PBCI	Support	VAF	ν
H5(-): ab_2 (via MNG)	-0.226	-0.5	-0.075	Yes	66.9%	0.051

JA: job autonomy; MNG: work meaningfulness; JS: job satisfaction; TRNV: turnover intention. Total, direct, and indirect effects are calculated, considering supervisor status, age, and length of service as control variables on JS and TRNV, respectively. PBCI: percentile bootstrap confidence interval. Bootstrapping was based on 10,000 subsamples. The indirect effect is assessed by applying a one-tailed test (PBCI 90%). Total and direct effects are assessed using a two-tailed test. VAF: variance accounted for.

Table 10. Predictive contribution of the mediator (PCM) results

Indicator	MNG PCM	Conclusion
MNG as mediator between JA and JS		
JS1	0.177	Strong
JS2	0.061	Moderate
JS3	0.170	Strong
MNG as mediator between JA and TRNV		
TRNV1	0.047	Weak
TRNV2	0.060	Moderate

MNG: work meaningfulness; JA: job autonomy; JS: job satisfaction; TRNV: turnover intention; PCM: predictive contribution of the mediator.

indicator can be interpreted following the threshold proposed by Gaskin, Ogbeibu, & Lowry (2023): 0.01 (small), 0.04 (medium), and 0.09 (large). Table 9 shows that the indirect effect ab_1 achieved a ν value of 0.132, which means a large mediation effect. For its part, ab_2 reached a medium effect size ($\nu = 0.051$). Both results aligned with the results achieved with the VAF assessment and underlined the outstanding mediating role of MNG in both indirect effects.

In addition, we assessed the two mediating relationships in our research model using a predictive approach. We designed two models that allow us to determine the predictive contribution of MNG as a mediator variable for each dependent construct (i.e., JS [Hypothesis 3] and TRNV [Hypothesis 5]). In this vein, we used the PCM metric (Danks, 2021) (Table 10). The SEMinR package (Ray et al., 2022) was used to estimate the PCM metrics for each indicator of JS and TRNV, respectively, considering 3 folds and 5,000 repetitions. Regarding the indirect effect of JA on JS via MNG, the three indicators of JS achieved PCM metrics above zero, with two of them showing a solid PCM (over 0.17). This means that MNG contributed substantially and provided strong confirmatory predictive evidence for the mediation effect on JS. Regarding the role of MNG as a mediator in the relationship between JA and TRNV, PCM estimates were also above zero but around 0.05 for the two manifest variables. This result provided almost moderate but confirmatory predictive evidence for the mediation effect of MNG. Both results provided additional post hoc evidence to support the generalizability of MNG as a mediator, as postulated by Hypotheses 3 and 5. Furthermore, our findings justified the added

complexity of including MNG as a mediating variable, as it produced an improved predictive accuracy of both JS and TRNV (Danks, 2021).

Discussion

Theoretical contributions

This study aimed to investigate the role of work meaningfulness among knowledge workers and its direct and indirect effects on turnover intentions and job satisfaction, framed by SDT and its key driving variable, job autonomy.

According to Hypothesis 1, our study supports previous literature identifying job autonomy as a key predictor of work meaningfulness, explaining 33.6% of the variance (Bailey et al., 2019). Consistent with prior research (Bailey et al., 2019), our findings also show that work meaningfulness on its own plays an important role in predicting job satisfaction, thus supporting Hypothesis 2. Researchers agree that work meaningfulness is a 'positive, subjective, individual experience' in relation to work, and emerging literature ties it to positive outcomes (Bailey et al., 2019).

Regarding the mediated hypotheses, our results indicate that work meaningfulness fully mediates the relationship between job autonomy and job satisfaction (Hypothesis 3) and between job autonomy and turnover intentions (Hypothesis 5). These findings deepen our understanding of how contextual and job design factors can facilitate psychological need satisfaction and, together with work meaningfulness, significantly predict job satisfaction and turnover intentions. As scholars note, specific psychological experiences are necessary for work to be perceived as meaningful (Martela et al., 2021), and employees must attain a minimum level of motivation to experience any utility from meaning (Nikolova & Cnossen, 2020).

Regarding Hypothesis 4, which predicts a negative relationship between work meaningfulness and turnover intentions, our results are in contrast to those of a meta-analysis that pointed to work meaningfulness performing more effectively in promoting well-being than in reducing negative emotions where the effects may be indirect rather than direct (Allan et al., 2019). Our results support the strength of work meaningfulness as a direct predictor of lower turnover intentions among knowledge workers, explaining 18.2% of the variance while showing that it is an even stronger predictor of job satisfaction.

In terms of our control variables, a notable and unexpected finding, although not hypothesized, was the increase in turnover intentions among supervisory-level employees (explaining 11.5% of the variance) and the decrease in job satisfaction (5.1% variance). This trend was similarly observed, although to a lesser extent, in employees with longer tenure. Thus, our study revealed that the impact of work meaningfulness on these work outcomes may vary for employees depending on their level of responsibility.

In our group of study participants, issues such as insufficient onboarding, lack of accountability, role ambiguity, and excessive working hours were raised. These challenges may frustrate the basic psychological needs of both supervisory and longer-tenured employees, who face excessive workloads due to inadequate training of new hires, a lack of well-defined roles, and the resulting absence of accountability. This frustration may explain the higher turnover intentions observed among these employees in our study. It may also clarify why our results differ from those of a study using a representative national sample from the Korean Labor and Income Panel Study. After following more than 1,500 people over an 11-year period, researchers found that longer job tenure was associated with lower turnover intention (Ju & Li, 2019).

Employees with low control of outcomes at work due to dynamics such as those mentioned above may experience competence, and autonomy need frustration. Combined with low reciprocity and social support at work, their third need, relatedness, may also be frustrated (Gonzalez, Niemiec, & Williams, 2015). An important factor to consider is that the tasks of knowledge workers, especially engineers, are based on mutual interdependencies; their work requires specialized input from various individuals, including co-workers and clients (Väänänen et al., 2020).

Therefore, it is crucial to support their need for relatedness, as it is essential for them to do their job effectively.

Looking at the darker side of work meaningfulness, employees who find their work meaningful may end up working long, erratic hours that may affect their work-life balance and undermine their close relationships outside of work (Bailey et al., 2019; Oelberger, 2019). Although research results point to belonging and unity as core elements of meaningfulness (Lips-Wiersma & Morris, 2009; Rosso et al., 2010), employees who experience work meaningfulness *may* feel a sense of belonging to the company. Nevertheless, other aspects of relatedness, such as collaboration, will not flourish without efficient and well-implemented processes, clearly defined roles, and a strategic road map. Good job design can support a firm's employees and can pave the way for goals such as effective teamwork, reducing work overload, and supporting resource allocation (Cooman, Stynen, Broeck, Sels, & Witte, 2013; Grant, Fried, Parker, & Frese, 2010). In order for this to occur, however, the firm must prioritize meeting employees' needs for autonomy, competence, and relatedness and, based on our results, ensure the inclusion of supervisory-level employees.

Researchers warn against explaining the meaning of work on single antecedents as employees draw meaning from many sources (Rosso et al., 2010). The dynamic multilevel framework of factors fostering meaningful work recently put forth by scholars (Lysova et al., 2019) proves that the nature of work is complex and dynamic and that changes in the job and organizational context impact how employees interact with their work environments. Our model, framed within SDT, offers a more integrative approach that supports both the antecedents and strengthens the outcomes of work meaningfulness. Scholars argue that a foundational grounding in basic psychological needs and motivational quality sets the scene for a highly motivated workforce and its ensuing positive outcomes for both employees and the firm. (Rigby & Ryan, 2018).

At the same time, autonomous motivation within SDT is strongly related to outcomes such as job satisfaction, well-being, attendance, and lower turnover (Gagné & Deci, 2005). This motivation is influenced by environmental factors via their effect on perceptions of competence, autonomy, and relatedness (Dysvik et al., 2013; Grouzet et al., 2004). In a meta-analysis of 99 organizational workforce studies across several cultures, the satisfaction of the needs for autonomy, competence, and relatedness was associated with lower turnover intentions (Van den Broeck et al., 2016). Satisfying these needs paves the way to fully experiencing work meaningfulness, its positive outcomes, and those resulting from autonomous motivation.

Practical implications

The causal-predictive nature of PLS-SEM allows researchers to obtain recommendations for practice (Hair et al., 2022). The results of our study have several implications for reducing turnover intentions in workplaces. First and foremost, work meaningfulness should be an essential element of retention models. Even its greater strength in predicting job satisfaction is necessary as it has been shown to significantly influence knowledge workers' choices to leave or remain with a firm (Chung et al., 2017; Jung, 2012; Richer et al., 2002).

Our study also demonstrated the importance of job autonomy as a driver of work meaningfulness. However, autonomy has been shown to have an illusory character for knowledge workers, as their work processes are embedded in a number of social and organizational relationships (Väänänen et al., 2020). Manufacturing companies with knowledge workers should adopt self-managing teams not only to increase the overlap of employees' knowledge (Foss, Minbaeva, Pedersen, & Reinholdt, 2009) but also to encourage teamwork and increase collaboration to satisfy the employees' relatedness needs. A study in the electric light industry and the telecommunications industry in China and Japan concluded that due to their effects on job satisfaction and turnover intention among knowledge workers, the motivating work characteristics of learning, autonomy, and significance should be considered a vital dimension of job characteristics. The author encouraged further research in different

industries (Huang, 2011). These characteristics mirror SDT's needs of competence and autonomy with significance included as a dimension of work meaningfulness.

Engineers have also been found to have a higher turnover rate than other professionals predominantly due to management ineffectiveness and a lack of satisfaction with supervisors (Hofaidhllaoui & Chhinzer, 2014). Thus, training managers to support their team's basic psychological needs is also imperative since employees who receive support from their superiors report, on average, higher levels of satisfaction (Blechman, Tóth-Király, Nadon, Fernet, & Morin, 2022). Managers who work to support their employees' needs also invest in the organization and its culture by fostering talent retention (Rigby & Ryan, 2018). Giving constructive feedback, recognizing employees, acknowledging different points of view, and supervising them in a way that is perceived as interest in the worker rather than reducing autonomy contributes to motivation and positive outcomes (Ariely, Kamenica, & Prelec, 2008), as does the frequency and quality of communication and fomenting group cohesion (Blechman et al., 2022).

Facilitating employee access to knowledge within and outside the organization is especially crucial for knowledge workers who constantly need to improve their skills. In a study of engineers across six firms in the United States, researchers found that the aspects of a job most valued by engineers were solving a problem, learning, and working in a team (Anderson, Courter, Mcglamery, Nathans-Kelly, & Nicometo, 2010).

Framing work meaningfulness within SDT could be an important step forward by ensuring high-quality motivation, which translates to employee retention and improves job satisfaction. In a three-wave sample of working adults, the results of an SDT-based conceptual model in which chronological age served as the moderator suggested that competence and autonomy-supportive HR practices were the most beneficial for employees regardless of their career stage (Laguerre & Barnes-Farrell, 2024).

Limitations and directions for future research

Despite its implications, this study has several limitations that should be addressed and that call for future investigations. First, although the research model explains more than half of the variance of work meaningfulness on job satisfaction and more than 40% of work meaningfulness on turnover intention, the influence of individual-level endogenous factors such as comparable alternative employment opportunities should be considered. Second, due to the nature of the industry, our sample was male-dominant. It would be interesting to replicate the study in a more gender equal setting. Third, while the sample involved only one division of one firm, it included a number of occupations and thus was representative of the company. Considering the increasingly warranted focus on work meaningfulness and its impact on turnover intention and job satisfaction, these results may be salient for knowledge workers in other firms and industries and we thus encourage scholars to test this model in different environments.

In terms of future research directions, there are some exciting possibilities. First, examining the three higher-order categories of autonomous work recently put forth by Parker (Parker & Knight, 2024), namely, timing autonomy, method autonomy, and decision-making autonomy, it would be useful to study the impact of each on work meaningfulness. Second, expanding the model to include measures for the satisfaction of competence and relatedness needs and comparing the results in terms of age, length of service, and supervisor status would be helpful, as the strength of particular needs may change over time.

Third, recent research points to the dynamic nature of turnover intentions (Jeong & Lee, 2023). Although our study was conducted at one point in time to gain current insight specific to the high turnover context of this particular company, conducting longitudinal studies that include additional organizational initiatives (apart from job autonomy) could shed more light on how to best support employee needs and sustain work meaningfulness to ensure employee well-being and positive work outcomes. Fourth, as leadership support is vital to ensuring the satisfaction of employees' autonomy, competence, and relatedness needs, further research could consider different types of leadership as

moderators to compare their effects on the relationship between work meaningfulness and turnover intentions. Fifth, further exploring the role of work meaningfulness within SDT for supervisory-level employees would be a valuable line of research, particularly given their critical and hard-to-replace roles and our results, which pointed to adverse outcomes for this particular group. Sixth, replicating this study in other countries would be beneficial in adding to our understanding of work meaningfulness across diverse cultural contexts. Finally, future research could adopt a qualitative approach to ensure that employees' voices are heard. This would enable researchers to explore in greater depth the underlying reasons for negative outcomes, such as increased turnover intention among supervisors and longer-tenured employees, and to develop strategies to prevent the loss of such valuable employees.

Conclusions

While previous studies have identified autonomy as a strong predictor of turnover intentions, our findings suggest that work meaningfulness, driven by job autonomy, predicts both lower turnover intentions and higher job satisfaction. Our results indicate that work meaningfulness, while a stronger predictor of job satisfaction than turnover intentions, should still be considered a crucial element in understanding and addressing turnover dynamics.

From an organizational perspective, the results of the present study highlight the importance of the organization's effort in catering to the needs of its employees. The strong relationships between job autonomy and work meaningfulness, between work meaningfulness and both turnover intentions and job satisfaction, underscore the crucial role of work meaningfulness. In work that is inherently meaningful both due to its complexity and its contribution to society (i.e., clean energy), fomenting and sustaining work meaningfulness remains crucial to retaining employees and enhancing their well-being. To achieve this, a firm's leadership and culture must prioritize supporting the three psychological needs of employees at all levels. The results of our study should apply not only to the manufacturing sector but also to other industries where knowledge workers are employed.

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Data availability statement. The data that support the findings of this study are available from the corresponding author, J.W. upon reasonable request.

Conflict of interest. The authors report that there are no competing interests to declare.

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