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Energy Management Self-efficacy: Validation of a New Measurement Tool Using Structural Equation Modelling

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Abstract

Amid a growing "human energy crisis" employee performance across organisational contexts (Onyemelukwe et al., 2023), an often-overlooked measurement gap persists. While human energy research has typically focused on energy management behaviours, it has underestimated the latent role of self-efficacy in pragmatically regulating their energy levels. This research addresses this gap by providing the first comprehensive validation of Richard Köhlmann's (2023) five-item Energy Management Self-Efficacy (SWE-E) scale, in a non-clinical working population. The data was extracted from a cross-sectional survey of 1,283 German-speaking workers and analysed using structural equation modelling (SEM). The scale's convergent validity was tested against general and professional self-efficacy; its discriminant validity from role conflict and self-endangering work behaviours; and its criterion-related validity in predicting vitality and work fatigue. The SWE-E scale demonstrated excellent internal consistency and structural integrity. Moderately strong positive relationships with general and professional self-efficacies, substantiated convergent validity. Discriminant validity was revealed through its distinction from role conflict and 10 self-endangering work behaviours, meeting both Fornell-Larcker and HTMT criteria. SWE-E demonstrated criterion-related in its strong positive association with vitality and moderately strong negative associations with work fatigue. Incremental validity was also accounted for, with SWE-E explaining substantial additional variance in vitality and all three dimensions of work fatigue, above and beyond the other two broader self-efficacy measures. The SWE-E scale is a reliable, valid, and practical instrument for measuring an employee's belief in their ability to self-regulate energy levels amidst work demands.

Keywords: self-efficacy, energy management, structural equation modelling, scale validation, vitality, work fatigue

Introduction

The ability of employees to marshal physical, cognitive, and emotional resources for purposeful work is under unprecedented strain. In Germany, energy-limiting conditions such as Myalgic Encephalomyelitis/Chronic Fatigue Syndrome and post-viral sequelae (e.g., Long COVID) already cost an estimated €63.1 billion, about 1.5 % of national GDP (ME/CFS Research Foundation, 2025). While clinical diagnoses and expenses, though severe, throw light on a broader organisational issue: a systemic depletion of human energy that threatens sustained performance and well-being. Recent reviews describe this phenomenon as a global "human energy crisis" (Onyemelukwe et al., 2023). Unlike time, which is fixed, human energy can be renewed; its skilful management therefore offers a leverage point for sustaining performance (Marks, 1977; Quinn et al., 2012). Empirical work confirms that training employees to manage their energy elevates day-to-day vitality and psychological health (Hahn et al., 2011; Das et al., 2019), and that proactive micro-strategies predict higher end-of-day vigour (Parker et al., 2017). To advance these interventions, organisations need a reliable way to gauge employees' confidence in regulating their own energy. The present study addresses this gap by validating the Subjective Work Energy Experience scale (SWE-E) in a large working sample.

Despite growing recognition that skilful energy regulation underpins sustainable work performance, a clear measurement gap remains. The most widely used instruments quantify how often employees take micro-breaks or employ other energy-management tactics (Albulescu et al., 2022; Bennett, 2015), generating helpful behavioural tallies but telling us little about the confidence that fuels those acts. However, decades of evidence show that self-efficacy—the conviction that one can organise and execute required actions—more strongly predicts initiation, intensity, and persistence of behaviour than knowledge or skill alone (Bandura, 1977; Stajkovic & Luthans, 1998; Wood & Bandura, 1989). Without a validated

scale that targets this belief in the energy domain, researchers cannot trace how work design, leadership, or individual dispositions cultivate the psychological leverage that sustains daily vitality.

Domain-specific Self-efficacy scales

The case for developing domain-specific measures finds strong support in Bandura's (2006) specificity principle, which argues that efficacy scales achieve their greatest predictive accuracy when items closely mirror the behaviours they seek to measure. Researchers have responded to this principle by creating tailored instruments for broad occupational functioning (Schyns & von Collani, 2002), proactive stress-recovery routines (Hahn et al., 2011), and clinical energy-conservation strategies for patients with Multiple Sclerosis (Liepold & Mathiowetz, 2005). Despite these advances in self-efficacy measurement for people with severe clinical conditions, a notable gap persists; existing psychometric instruments fail to capture the everyday, forward-looking self-regulation that healthy employees need to sustain their momentum across increasingly permeable work-life boundaries (Thayer et al. 1994). This oversight is significant. Failures in proactive self-regulation link directly to decrements in well-being and performance, including burnout and disengagement (Sonnentag et al., 2017).

This gap becomes particularly pronounced in the domain of energy management. Clinical research has demonstrated the value of conceptually similar constructs in treating severe energetic health conditions, providing important theoretical foundations for the present work. For instance, Hersche and colleagues (2023) illustrate how researchers have adapted clinical measures when examining post-COVID fatigue in working adults, adopting the Self-Efficacy for Performing Energy Conservation Strategies Assessment originally validated with MS patients (Hersche et al., 2023; Liepold & Mathiowetz, 2005). Similar adaptations appear in a scoping review of energy-management education (Farragher et al., 2020) and a meta-

analysis of therapist-led fatigue interventions (Kim et al., 2022). These clinical precedents establish both feasibility and value. Adapting energy-focused measures across populations works.

But these clinical scales focus on symptom-management routines. They use medical language. Healthy employees also face different challenges requiring them to regulate their energy amid routine job demands rather than managing severe health conditions (Mitchell et al., 2019). The face validity simply isn't there. The absence of a valid and reliable instrument designed specifically for healthy working populations creates a significant methodological challenge for occupational researchers (Wright et al., 2017). Practitioners also currently lack a diagnostic tool to identify employees who may struggle to sustain their energy effectively in workplace settings—a critical need given the centrality of personal resources to navigating modern work demands and their established links to performance outcomes (Stajkovic & Luthans, 1998).

To address this identified gap, the focal construct of this investigation, Energy Management Self-Efficacy (SWE-E), was first operationalised by Richard Köhlmann (2023) in a Master's Thesis. Köhlmann (2023) defined SWE-E as an individual's belief in their capability to successfully regulate their personal energy levels in the face of work-related demands. The present study undertakes a formal validation of this five-item instrument that Köhlmann (2023) developed initially and explicitly piloted for non-clinical populations, particularly healthy employees navigating ordinary workplace demands.

Köhlmann's (2023) initial research took the form of an intervention-focused diary study with N = 118 participants, designed to evaluate how personalised feedback affects energy management behaviours. Within this context, SWE-E revealed theoretically consistent correlations with several key constructs at the between-person level. The findings were encouraging, with the scale producing significant positive between-person correlations with

participants' clarity regarding their daily energy patterns (KE; $r = .47$, $p < .01$), their engagement in self-related work reflection (SAR; $r = .17$, $p < .01$), and their subjective vitality (VIT; $r = .21$, $p < .01$). As anticipated, SWE-E produced a significant negative correlation with fatigue (FAT; $r = -.19$, $p < .01$). These results suggested that individuals who felt more confident in their energy management abilities also demonstrated greater awareness of their energy fluctuations, engaged more deeply in reflective practices, experienced higher vitality, and reported less fatigue.

While Köhlmann's (2023) initial findings offer promise, their development within a specific intervention context limits the broader conclusions that can be drawn about the scale's properties and utility. The study's primary purpose was to evaluate an intervention, not to conduct a formal scale validation. As such, the study served as a vital proof of concept while simultaneously acknowledging the lack of systematic tests for convergent and discriminant validity, which necessitated the current investigation (Köhlmann, 2023).

Building upon these clinical insights while addressing the distinct needs of non-clinical populations, an occupation-specific SWE-E scale can fill this methodological gap. By conceptualising energy regulation as a proactive workplace skill, SWE-E promises to capture variance that illness-focused tools overlook. A validated measure tailored to organisational settings would allow researchers to investigate how job design and leadership nurture this agentic belief; it would provide employers with a sensitive indicator for evaluating initiatives, particularly targeted energy management interventions (Albulescu et al., 2022; Das et al., 2019; Op den Kamp et al., 2018). The scale thus offers a purpose-built gauge of a resource that is increasingly central to sustainable work performance.

This research provides the first systematic validation of SWE-E using structural equation modelling on a large workforce sample. Where Köhlmann's initial study tested a limited set of correlates, this investigation positions SWE-E within a comprehensive

nomological network that includes established self-efficacy measures, environmental stressors, maladaptive coping behaviours, and crucial well-being outcomes.

Theoretical Framework

The validation of any new psychological instrument requires a theoretical foundation that both clarifies the focal construct and positions it within a broader nomological network. Based on Bandura's (2001) Social Cognitive Theory (SCT), this validation rests on three pillars grounded in Bandura's principle of triadic reciprocal causation (Wood & Bandura, 1989) wherein personal factors (e.g. self-efficacy), behaviour, and the environment influence each other but remain conceptually distinct (Bandura, 2001). Within this dynamic system, self-efficacy is the pivotal personal resource: a generative belief that helps shape goal setting, effort, and resilience at work (Bandura & Locke, 2003). SWE-E represents a personal cognitive factor (one's belief about their own capability), while constructs including role conflict represent environmental factors, and self-endangering work behaviours represent behavioural factors. While these elements interact—high role conflict may erode SWE-E over time, and low SWE-E may lead to maladaptive behaviours—they are conceptually distinct constructs that should be empirically separable.

Because predictive power is maximised when an efficacy measure matches its performance domain (Bandura, 2006), validating a domain-specific scale such as the SWE-E is essential. The present framework casts SWE-E not merely as a belief but as a personal resource that empowers individuals to navigate workplace demands agentically, translating supportive contexts into sustained vitality and engagement. Validating the SWE-E scale will, thereby, advance research into how work design, leadership, and proactive strategies bolster employees' confidence in managing their energy and, by extension, their capacity for healthy, high performance.

Current Research and Scale Validation

Given this integrated view, SWE-E must satisfy three facets of validity based on theory-driven insights. First, because SWE-E is conceived as a narrow, task-focused belief nested within the wider hierarchy of self-efficacy, it should correlate positively (significantly) with generalised and occupational self-efficacy, demonstrating convergent validity without sacrificing distinctiveness. Second, if SWE-E truly functions as an agentic personal resource, it must remain empirically separate from constructs that capture environmental stressors or maladaptive coping, thereby evidencing discriminant validity in line with SCT's triadic model. Third, the scale should demonstrate its practical value by predicting higher vitality and lower work fatigue. These theoretical expectations frame the study's research questions and hypotheses, which are tested via structural equation modelling in a German workforce sample.

The validation itself is achieved by positioning the construct within a nomological network that addresses three central research questions:

- To what extent does SWE-E demonstrate convergent validity by correlating with established measures of general and occupational self-efficacy?
- Is SWE-E empirically distinct from theoretically unrelated constructs, such as self-endangering behaviours and role conflict (discriminant validity)?
- Does SWE-E predict relevant well-being outcomes, such as vitality and work fatigue (criterion-related validity)?

Convergent Validity with Self-Efficacy Hierarchy

To establish the convergent validity of the SWE-E, it must be strongly associated with other self-efficacy constructs based on theoretical expectations regarding the hierarchical nature of efficacy beliefs. Self-efficacy is best understood as a hierarchical concept, with beliefs organised at varying levels of generality (Chen et al., 2001a; Scholz et al., 2002). At the apex lies Generalised Self-Efficacy (SWE), a broad, trait-like belief in one's ability to

cope with novel or difficult situations across various contexts (Schwarzer & Jerusalem, 1995, 2003). At an intermediate level is Professional or Occupational Self-Efficacy (BSWE), which captures an individual's confidence in their ability to successfully fulfil the tasks and meet the demands of their specific job role (Schyns & von Collani, 2002). SWE-E represents an even more specific domain, focused on the regulation of personal energy.

According to SCT, these levels are not independent. Generalised efficacy beliefs provide a foundational level of confidence that informs expectations in more specific domains (Bandura, 2001). An individual with high generalised self-efficacy is likely to approach their professional role with greater confidence, and this occupational confidence, in turn, provides a basis for believing they can manage the specific energetic demands of that role. This cascading influence means that while domain-specific measures possess greater predictive power for corresponding behaviours (Bandura & Locke, 2003), a positive association across the hierarchy is expected. The meta-analytic work of Stajkovic and Luthans (1998) confirms this relationship, that strong links emerge between efficacy beliefs and performance across various levels of specificity. Therefore, if SWE-E belongs in this hierarchy, it should correlate positively with its broader counterparts while maintaining distinctiveness. This leads to initial hypotheses:

H1: Energy Management Self-Efficacy will be moderately to largely positively correlated with Generalised Self-Efficacy.

H2: Energy Management Self-Efficacy will also reflect a moderate-to-high positive association with Professional Self-Efficacy.

Discriminant Validity from Environmental and Behavioural Constructs

Confirming discriminant validity requires demonstrating that SWE-E is empirically distinct from constructs that, while related to workplace stress and coping, do not measure an

agentic belief. Two such constructs, chosen for their theoretical relevance, are Role Conflict and Self-Endangering Work Behaviours.

Role Conflict (RK) refers to the experience of facing incompatible or contradictory work demands, operationalised by the seminal Role Conflict and Ambiguity scale developed by Rizzo and colleagues (1970). This construct captures an external, environmental stressor—a property of the work environment that can deplete personal resources and undermine efficacy over time. However, it is conceptually distinct from an individual's internal belief about their capacity to manage the resulting strain.

Self-Endangering Work Behaviours (ISG) represent a set of maladaptive coping strategies where employees systematically compromise their health and well-being to meet work goals. This multidimensional concept, refined by researchers including Krause et al. (2015) and Dettmers et al. (2016), captures behaviours such as working while sick (presenteeism), forgoing breaks, extending working hours, and intensifying work pace. The most recent German instrument for ISG (Mustafić et al., 2023) captures ten such dimensions, and the concept has been validated cross-culturally (Yokoyama et al., 2022). These behavioural patterns often emerge as responses to high work overload (Mander & Antoni, 2023) and can be viewed as failures of effective self-regulation (Mülder et al., 2021; Steel et al., 2022).

A valid measure of an agentic belief should not be confused with measures of the environment it navigates or the maladaptive behaviours it prevents. SCT's triadic model predicts interactions, such as low SWE-E predicting higher ISG, or a stark role conflict might attenuate SWE-E, but the constructs remain fundamentally distinct. Hence, only weak (if any) negative associations are expected:

- **H3:** Energy Management Self-Efficacy will show weak/non-significant correlations with Role Conflict.

- **H4:** Energy Management Self-Efficacy will form negligible to weak negative correlations with the 10 different dimensions of Self-Endangering Work Behaviours.

Criterion-Related Validity with Well-Being Outcomes

Finally, criterion-related validity is examined by demonstrating that SWE-E predicts relevant outcomes in a theoretically consistent manner. A measure's ultimate value lies in its ability to predict meaningful outcomes, and for energy management, the primary goals are maintaining positive energetic states and preventing negative ones.

The primary positive outcome of interest is vitality, defined as a state of positive energy, aliveness, and enthusiasm (Ryan & Frederick, 1997). This construct represents more than mere energy; it captures the subjective experience of feeling energised and fully alive. Vitality is most famously operationalised by Ryan and Frederick's (1997) 7-item Subjective Vitality Scale, with a validated 3-item German short form developed by Fritz et al. (2011) for use in knowledge worker populations.

The primary negative outcome is work fatigue, a multidimensional construct comprising physical, mental, and emotional depletion. This complex phenomenon is captured by the Three-Dimensional Work Fatigue Inventory (3D-WFI) created by Frone and Tidwell (2015) and subsequently validated in a German-speaking context by Frone et al. (2018). The multidimensional nature of work fatigue, which encompasses physical tiredness, mental exhaustion, and emotional depletion, has been confirmed across various studies (Blais et al., 2020; Trógolo et al., 2020). These energetic states are not static; they fluctuate dynamically (Sonnentag et al., 2017), with evidence showing distinct weekly patterns for vitality and fatigue (Weigelt et al., 2021), making their regulation a constant challenge.

However, to establish the practical utility of SWE-E, this research goes beyond bivariate links to examine its incremental validity with a more stringent test assessing

whether a new measure predicts outcomes above and beyond established constructs. This test strikes at the heart of the specificity principle (Bandura, 2006). Because SWE-E targets energy regulation precisely, it should outperform broader, more distal measures such as generalised or professional self-efficacy when predicting energy-related outcomes. Demonstrating this incremental contribution proves the scale's unique value. Without it, one might argue that existing measures suffice.

This leads to the final, most demanding set of hypotheses:

- **H5:** Energy Management Self-Efficacy will possess a moderate-to-high positive bivariate link with vitality.
- **H6:** Energy Management Self-Efficacy will be moderately to highly negatively correlated with the dimensions of work fatigue.

Methods

Research Design

A cross-sectional survey study was conducted with German-speaking working adults, to validate the SWE-E scale. SEM was utilised to establish convergent, discriminant, and criterion-related validity, through systematic comparison with established psychological constructs.

Participants and Sampling

From an initial dataset of 2,374 cases, 1,091 were excluded based on three non-mutually exclusive criteria; lack of consent or non-serious participation (n = 595), failed attention checks (n = 902), or insufficient completion time (n = 510), yielding a final sample of N = 1,283 participants. The completion-time threshold was set at the first quartile of the response time distribution for both the short (253 seconds) and long (1,275 seconds) survey versions, to filter out rapid, non-engaged responses while retaining data from participants who may have taken legitimate breaks (DeSimone et al., 2018).

Participants were recruited via two primary channels. A portion of the sample consisted of psychology students from a large distance-learning university who received course credit for their participation via the SONA system; these individuals completed the long version of the survey. The remaining participants were recruited from a student listserv and, as they received no compensation, were offered a choice between the long and short survey versions. No direct personal identifiers were collected to ensure participant privacy. Due to the non-sensitive nature of the survey items and the fully anonymised data collection protocol, the study was exempt from a formal ethics committee review.

Measures and Materials

Unless specified otherwise, all measures used 5-point Likert scales (1 = strongly disagree, 5 = strongly agree):

- Energy-Management Self-Efficacy (SWE-E) was measured with a 5-item scale assessing confidence in managing personal energy (e.g., "I am confident in my ability to manage my energy effectively throughout the workday") (Köhlmann, 2023).
- General Self-Efficacy (SWE) was assessed using the well-established 10-item scale by Schwarzer and Jerusalem (1995), which measures a general sense of personal competence (e.g., "I always succeed in solving difficult problems if I put my effort into it").
- Professional Self-Efficacy (BSWE) was measured with an 8-item scale that captures beliefs about one's abilities within their professional role (e.g., "I feel up to most professional challenges") (Schyns & von Collani, 2002).
- Role Conflict (RK) was measured using the 8-item scale by Rizzo et al. (1970) to assess perceived incompatibility between work demands (e.g., "I receive requests at work from two or more people that contradict each other").

- Subjective Vitality (VIT) was assessed with the 7-item scale from Ryan and Frederick (1997), which measures the subjective experience of being energetic and alive (e.g., "I feel alive and vital").
- The Three-Dimensional Work Fatigue Inventory (3D-WFI), an 18-item scale, was used to capture the multifaceted nature of work-related fatigue (Frone et al., 2018). It comprises three distinct 6-item subscales: Physical Fatigue (e.g., "At the end of a workday, how often have you felt physically exhausted?"), Mental Fatigue (e.g., "At the end of a workday, how often have you had difficulty thinking and concentrating?"), and Emotional Fatigue (e.g., "At the end of a workday, how often have you felt emotionally drained?").
- Self-Endangering Work Behaviour (ISG) was measured with a 35-item scale comprising ten distinct dimensions of maladaptive work behaviours (Mustafić et al., 2023). The dimensions are: Foregoing leisure-time recovery (e.g., "I cancel private appointments in favour of work."), Lowering quality under time pressure (e.g., "When under time and/or performance pressure, I reduce the quality of my work."), Working despite illness/‘presenteeism’ (e.g., "I drag myself to work even when I am ill."), Substance use for stimulation (e.g., "I boost my performance with substances [e.g., coffee, energy drinks, stimulants]."), Working during leisure time (e.g., "I read work e-mails in my leisure time."), Permanently lowering quality (e.g., "I work with poorer quality than customers and/or supervisors expect of me."), Intensifying and extending work (e.g., "I work longer than contractually agreed."), Feigning (e.g., "I embellish information in reports used for performance monitoring."), Foregoing interaction at work (e.g., "During work I forgo interaction with my colleagues."), and Skipping breaks at work (e.g., "I skip a lunch break.").

Data Preparation and Assumption Checks

Invalid codes (e.g., −77, 0) were recoded to NA. Little's MCAR test was non-significant, χ^2 (1,057) = 1,089, p = .22, suggesting data were missing completely at random. Consequently, Full Information Maximum Likelihood (FIML) under the *MLR* estimator was retained, as it remains unbiased under these conditions. Univariate skewness (−0.67 to 1.75) and kurtosis (−1.38 to 3.91) were within ranges considered acceptable for solid *MLR* estimation. The Mahalanobis D^2 statistic flagged 12 multivariate outliers ($p < .001$), which were retained, as their exclusion did not impact the model fit. Multicollinearity was not a concern, as all Variance Inflation Factors (VIFs) ranged from 1.15 to 2.03, and the highest latent correlation was |0.74|, which is well below common thresholds.

Data-Analytic Strategy

All models were estimated in R (v. 4.4.0) using the lavaan package (Rosseel, 2012). To test the psychometric properties of the SWE-E scale, a sequential approach was deliberately chosen to manage model complexity, as a full 12-factor model (SWE-E, role conflict, ISG; the largest model) would require estimating about 216 free parameters, leaving only 6 cases per parameter with N = 1283; this is below the commonly recommended multilevel SEM (ML-SEM) stability guideline of 10 : 1 (Bagozzi & Yi, 2011; Kline, 2023; Muthén & Muthén, 2002). In order to preserve adequate case-to-parameter ratios, the analyses were run on smaller, conceptually linked blocks of three (overarching) latent variables (Bagozzi & Yi, 2011).

1. Convergent Validity (H1, H2): A CFA including the three self-efficacy scales (SWE-E, SWE, and BSWE) was conducted.
2. Discriminant Validity (H3, H4): A second, larger measurement model was estimated, including SWE-E, Role Conflict, and the ten dimensions of ISG.
3. Criterion-Related Validity (H5, H6): Finally, three variations of a structural model were tested to examine the predictive power of SWE-E on Vitality and the three Work

Fatigue dimensions: a general model (SWE-E + VIT + WFI-P + WFI-M + WFI-E) to observe the bivariate links; Models 1 (SWE + BSWE + VIT + WFI-P + WFI-M + WFI-E) and 2 (SWE-E + SWE + BSWE + VIT + WFI-P + WFI-M + WFI-E) were run to statistically control for BSWE and SWE, to check for incremental validity (ΔR^2) of SWE-E (Kline, 2023).

Across all models, global fit was assessed by examining a combination of fit indices, including the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardised Root Mean Square Residual (SRMR), against cut-offs (CFI/TLI ≥ .90, RMSEA ≤ .06, SRMR ≤ .08) deemed appropriate (Hu & Bentler, 1999). To evaluate the quality of the measurement models, several key parameters were examined. To assess the internal consistency of the scales, McDonald's Omega (ω) coefficients were computed, with values of ω ≥ .70 considered acceptable (Flora, 2020). Omega was chosen over the more traditional Cronbach's Alpha (α), as it provides a more accurate estimate of reliability by not assuming that all items are equally related to the latent factor; this restrictive assumption, also known as tau-equivalence, is seldom met in practice (Flora, 2020).

Convergent validity was further assessed with Average Variance Extracted (AVE), which should be > .50 to indicate that a factor explains more variance in its indicators than is due to error (Kline, 2023; Rönkkö & Cho, 2022). For each item, the standardised factor loadings (λ) were judged ideal when λ ≥ .70 (Kline, 2023); loadings of .50 ≤ λ ≤ .69 were kept only if theoretically essential, and .40 < λ ≤ .49 was retained solely when essential and the other criteria(ω ≥ .70, AVE ≥ .50, global fit) were met (Bagozzi & Yi, 2011; Cheung et al., 2024; Kline, 2023).

Discriminant validity was assessed using two established criteria derived from the parameters of the measurement model. First, the Fornell-Larcker criterion was applied ($\sqrt{AVE}$

> φ), which stipulates that a construct should share more variance with its own indicators than with any other construct (i.e. its correlation with the other construct) to reflect discriminant validity (Rönkkö & Cho, 2022). This is demonstrated when the square root of a construct's AVE is greater than its correlation with any other construct in the model (Rönkkö & Cho, 2022). Second, the Heterotrait-Monotrait (HTMT) ratio of correlations was calculated for each pair of latent factors in the model. This metric is derived by comparing the average correlation between the items of two different constructs (the heterotrait correlations) with the average correlation among the items within each of those same constructs (the monotrait correlations) and essentially provides an estimate of the correlation between constructs if they were perfectly measured (Rönkkö & Cho, 2022).

Following modern best-practice recommendations, a value below the strict criterion of .85 is considered indicative of good discriminant validity (Rönkkö & Cho, 2022). Following Cohen's (1988) conventions, the standardised latent factor covariances (φ) were interpreted as small ($|\varphi| \geq .10$), medium ($|\varphi| \geq .30$), or large ($|\varphi| \geq .50$). Similarly, Cohen's (1988) f^2 was utilised to interpret the additional variance explained by SWE-E (ΔR^2), where values of $f^2 = .02$, $f^2 = .15$, and $f^2 = .35$ represent small, medium, and large effects, respectively.

Results

This section presents the empirical findings from the statistical analyses conducted to validate the SWE-E and test the six hypotheses outlined in the introduction. The analytical sequence follows the conventional two-step approach for SEM. First, the psychometric properties of the measurement models are established through descriptive statistics, reliability analyses, and a series of CFAs. Second, after confirming the validity of the measures, the structural model is tested to evaluate the hypothesised relationships between the latent

constructs, through their correlations with each other, as is provided by default in the CFA output (Rosseel, 2012). All table values are rounded off to two decimal places for clarity, while others are rounded off to three decimal points for accuracy when relying on thresholds.

Descriptive Statistics and Reliability

The initial phase of the analysis involved an examination of the descriptive statistics and psychometric properties of the measures used in the study. The construct reliability coefficients and AVEs for the primary latent constructs are presented in Table 1 (see below), with facet-level descriptives appearing in Table A1 (Appendix A). All subsequent models were estimated using a good MLR estimator; missing data were handled with FIML, as detailed in the Method section.

Table 1

Reliability and Average Variance Extracted for All Latent Constructs

Construct	ω	AVE
Primary Constructs		
Energy Management Self-Efficacy (SWE-E)	.92	.70
General Self-Efficacy (SWE)	.91	.50
Professional Self-Efficacy (BSWE)	.90	.52
Role Conflict (RK)	.90	.53
Vitality (VIT)	.95	.74
Work Fatigue (WFI) Facets		

WFI-P (Physical)	.95	.76
WFI-M (Mental)	.95	.76
WFI-E (Emotional)	.96	.80
Self-Endangering Work Behaviour (ISG) Facets		
ISG-VAF (Work-private life conflict)	.87	.63
ISG-SQZ (Squeezing out breaks)	.91	.72
ISG-P (Presenteeism)	.97	.89
ISG-SK (Sickness)	.93	.77
ISG-AF (Neglecting safety regulations)	.86	.60
ISG-DSQ (Decline in quality)	.83	.55
ISG-IAA (Impairment-avoiding ambition)	.68	.45
ISG-VT (Overtime)	.83	.62
ISG-VAA (Annual leave)	.77	.54
ISG-VP (Neglecting social contacts)	.65	.39

Note. ω = McDonald's Omega; AVE = Average Variance Extracted. Reliability and AVE values are drawn from the respective measurement models in which they were tested (i.e., the convergent validity model for the primary constructs, the criterion model for WFI facets, and the discriminant validity model for ISG facets).

The preliminary diagnostics corroborated data suitability (skewness: −0.67 to 1.75; kurtosis: −1.38 to 3.91) for the MLR estimation method (Kline, 2023). As Table 1 shows, all of the primary constructs demonstrated good-to-excellent internal consistency ($.83 \leq \omega \leq .97$), well above the .70 threshold for acceptable reliability (Flora, 2020; Kline, 2023). These reliability estimates support confident interpretation of subsequent parameter estimates. A review of the latent correlation matrix provided an initial look at the relationships between the constructs. The strongest positive correlation was between SWE and BSWE at $\varphi = .76$ (see Table 2, below). The strongest negative correlation was observed between SWE-E and mental work fatigue (WFI-M) at $\varphi = -.50$ (see Table 5, below).

Finally, the AVEs met the criterion for most primary constructs (AVE > .50), including BSWE (AVE = .52). There were unexpected methodological observations, indirectly related to the validation of SWE-E, observed only in two first-order dimensions of ISG, specifically impairment-avoidant ambition (ISG-IAA; AVE = .45) and neglecting social contacts (ISG-VP; AVE = .39). This reflects the fact that the items for these two dimensions of ISG may lack convergent validity in this sample and should be interpreted with caution in the subsequent discriminant validity analyses.

Convergent Validity: Links among SWE-E, SWE, and BSWE

To formally assess the convergent validity of the SWE-E scale, a confirmatory tri-factor model was conducted. Convergent validity is the extent to which a measure correlates positively with other measures of the same or similar constructs. This was tested by specifying a three-factor measurement model comprising SWE-E, SWE, and BSWE. The global fit of this model was evaluated against multiple indices to provide a comprehensive assessment. The fit to the data was adequate: scaled χ^2 (227, N = 1,283) = 1519.48, $p < .001$; CFI = .915; TLI = .905; RMSEA = .067, 90% CI [.064, .070]; SRMR = .045; all indices met established criteria for acceptable model fit (Hu & Bentler, 1999). All of the items

demonstrated statistically significant and mostly strong loadings on their respective factors, with .46 to .91. Although one loading (.46) fell below .50, the remaining exceeded .50, while the composite reliabilities (.92, .91, .90) and AVEs (SWE-E = .70, SWE = .50, BSWE = .52) met or surpassed conventional thresholds (Cheung et al., 2024). This combination of results thus substantiates the fact that the proposed three-factor structure is sound, and affirms the following latent correlations observed in Table 2, below (Cheung et al., 2024; Hu & Bentler, 1999; Kline, 2023).

Table 2

Latent Correlations for Self-Efficacy Constructs

Construct	**SWE-E**	**SWE**	**BSWE**
Energy Management Self-Efficacy (SWE-E)	—		
General Self-Efficacy (SWE)	.49***	—	
Professional Self-Efficacy (BSWE)	.56***	.76***	—

Note. Values are latent variable correlations from the three-factor convergent validity measurement model. *** $p < .001$.

As predicted in **H1**, the latent correlation between SWE-E and SWE was positive and statistically significant ($\varphi = .49$, $p < .001$). Similarly, as predicted in H2, the correlation between SWE-E and BSWE was also positive and statistically significant ($\varphi = .56$, $p < .001$). As both correlations were statistically significant and in the expected (positive) direction, H1 and H2 were supported, confirming the convergent validity of the SWE-E scale.

Discriminant Validity: Links among SWE-E, RK, and ISG's 10 dimensions

The next step was to assess the discriminant validity of SWE-E, which was tested in relation to RK and the ten first-order dimensions of ISG. A comprehensive 12-factor measurement model was specified, and its global fit was found to be good, suggesting the proposed factor structure was a strong representation of the data: scaled χ^2 (1109, N = 1,283) = 3152.72, p < .001; CFI = .944; TLI = .938; RMSEA = .038, 90% CI [.036, .039]; SRMR = .040.

Table 3

Fornell-Larcker Criterion Matrix for Discriminant Validity

Construct	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. SWE-E	**.83**											
2. RK	**−.31**	.73										
3. ISG-VAF	**−.23**	.22	.80									
4. ISG-SQZ	**−.29**	.30	.19	.85								
5. ISG-P	**−.13**	.19	.42	.00	.94							
6. ISG-SK	**−.12**	.13	.19	.09	.14	.88						
7. ISG-AF	**.01**	.06	.54	.02	.41	.17	.77					
8. ISG-DSQ	**−.21**	.31	.24	.42	.03	.07	.14	.74				
9. ISG-IAA	**−.10**	.26	.56	.04	.39	.20	.49	.12	.67			
10. ISG-VT	**−.18**	.30	.17	.42	.11	.19	.10	.31	.10	.79		

11. ISG-VAA	**−.22**	.15	.19	.09	.12	.02	.06	.19	.17	.11	.74	
12. ISG-VP	**−.18**	.22	.42	.02	.38	.11	.38	.08	.50	.01	.29	.63

Note. Values on the diagonal are the AVEs, while off-diagonal values are the latent correlations of SWE-E with other constructs. For full construct names, refer to Table 1.

To provide a stringent assessment, two established criteria were employed. As shown in Table 3 above, the Fornell and Larcker (Rönkkö & Cho, 2022; Rosseel, 2012) criterion was examined and met for SWE-E; the square root of its AVE ($\sqrt{AVE}_{SWE\_E}$ = .83) exceeded its highest absolute correlation with any other construct within this specific model, which was its correlation with role conflict (φ = |−.31|). This means that SWE-E explains more variance in its own indicators than it shares with any other latent construct in the model, thereby evidencing its discriminant validity under the Fornell-Larcker criterion. It should be noted that all correlations were as per theoretical expectations: weak negative associations between SWE-E and all ISG dimensions (φ < .30), excepting ISG-AF (neglecting safety regulations; φ = .01) with virtually no relationship, and a moderately negative association with role conflict (φ = −.31).

Table 4

Heterotrait-Monotrait (HTMT) Matrix for Discriminant Validity

Construct	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. SWE-E	—											

2. RK	.32	—									
3. SG-VAF	.24	.21	—								
4. ISG-SQZ	.31	.32	.21	—							
5. ISG-P	.14	.18	.44	.04	—						
6. ISG-SK	.11	.12	.17	.09	.13	—					
7. ISG-AF	.03	.05	.57	.03	.43	.16	—				
8. ISG-DSQ	.22	.32	.24	.46	.03	.07	.12	—			
9. ISG-IAA	.06	.32	.45	.06	.39	.27	.38	.12	—		
10. ISG-VT	.20	.34	.22	.47	.15	.21	.13	.39	.20	—	
11. ISG-VAA	.24	.16	.18	.06	.15	.03	.07	.11	.18	.09	—
12. ISG-VP	.20	.24	.40	.04	.40	.09	.36	.08	.54	.02	.28	—

Note. Values are the HTMT ratio of correlations. Values below .85 provide evidence for discriminant validity. For corresponding construct names, see Table 1.

Second, the HTMT was calculated (see Table 4 above). The analysis revealed that the highest observed HTMT value involving SWE-E was a modest .32 with role conflict. This value is well below the conservative .85 threshold that is sometimes used to flag potential discriminant validity issues. Notwithstanding the AVEs observed, the joint evidence provides strong support for rejecting the null, and that SWE-E scale being empirically distinct from RK and ISG. Therefore, H3 and H4 were supported.

Criterion-related Validity: Links among SWE-E, Vitality, and WFI's three dimensions

The final stage of the analysis assessed the criterion-related validity of SWE-E over two steps: first, by examining the bivariate correlations between SWE-E and its proposed outcomes from the general 5 factor model (SWE-E, Vitality, WFI-P, WFI-M, WFI-E), and second, by testing its incremental validity in a structural model that controlled for SWE and BSWE. As a first step, the latent covariance matrix of all 3 overarching constructs was calculated and provided in Table 5. The structural model fit the data adequately: robust χ^2 (395, N = 1 283) = 1 927.10, p < .001; CFI = .957; TLI = .953; RMSEA = .060, 90 % CI [.057, .063]; SRMR = .033, indicating strong CFI, TLI, and SRMR values, while the RMSEA barely suffices.

Table 5

Full Latent Correlation Matrix for All Constructs in the Structural Model

Construct	**1**	**2**	**3**	**4**	**5**
1. SWEE	—				
4. VIT	**.60**	—			
5. WFI-P	**−.42**	−.49	—		
6. WFI-M	**−.50**	−.52	.70	—	
7. WFI-E	**−.45**	−.46	.62	.79	—

Note. All correlations are statistically significant at $p < .001$. Important bivariate links with SWE-E (Energy Management Self-Efficacy) are in bold.

Table 5 shows SWE-E demonstrated a strong, positive correlation with vitality (φ = .60, $p < .001$), while still being aligned with H5. SWE-E's correlation with vitality was even higher than with SWE (φ = .49) and BSWE (φ = .56). Also, SWE-E exhibited high to moderate negative correlations with the three dimensions of work fatigue (ranked in descending order of magnitudes): mental (φ = −.50, p < .001), emotional (φ = −.45, p < .001), and physical (φ = −.42, p < .001). These findings offered solid preliminary support for H6.

Table 6

Explained variance in outcomes with and without the SWE and BSWE Predictors

Outcome Variable	**Model 1 (R_1^2)**	**Model 2 (R_2^2)**	**ΔR^2**	**$f^2 = \frac{(\Delta R^2)/}{1 - R_2^2}$**
Vitality	.21	.40	.19	.32
Physical Fatigue	.06	.18	.12	.15
Mental Fatigue	.10	.25	.15	.20
Emotional Fatigue	.01	.21	.20	.25

Note. Model 1 extricates SWE-E and contains SWE, BSWE, vitality, and 3D-WFI; Model 2 adds SWE-E as well. ΔR^2 represents the (incremental) change in explained variance from Model 1 to Model 2. All R^2 values are based on latent variable estimates from the SEM outputs, with Cohen's f^2 (1988) included for effect size estimation.

As summarised in Table 6, SWE-E explained an additional 19% of variance in vitality ($f^2 = 0.32$), 20% in emotional fatigue ($f^2 = 0.25$), 15% in mental fatigue ($f^2 = 0.20$), and 12% in physical fatigue ($f^2 = 0.15$); all of the observed incremental variances possessed medium effect sized (Cohen, 1988). Additionally, the standardised paths from SWE-E remained sizeable and statistically significant: $\beta = .53$ for vitality, $\beta = -.43$ for physical fatigue, $\beta = -.47$ for mental fatigue, and $\beta = -.40$ for emotional fatigue (all $p < .001$). These results confirm that SWE-E provides a substantial and practically meaningful contribution to the explanation of work fatigue and vitality, strongly substantiating empirical support for all research hypotheses (H5 and H6) In fact, all six main hypotheses were affirmed, as all six corresponding null hypotheses were rejected.

Discussion

This research set out with a clear goal: to rigorously validate the SWE-E scale for a non-clinical, working population. Using structural equation modelling on data from 1,283 German-speaking workers, the study confirms that this five-item scale is not only psychometrically sound but also holds meaningful connections to other important workplace constructs. This successful validation gives researchers and practitioners a theoretically solid, practical tool to measure how confident employees are in managing their own energy.

The findings provided clear support for all six of the study's hypotheses. The scale itself demonstrated excellent internal consistency ($\omega = .92$) and structural integrity (AVE = .70), indicating its five items effectively measure a single, coherent concept (Flora, 2020; Kline, 2023). As a measure of self-efficacy, it behaved just as the theory would predict. It was moderately to highly correlated with both general self-efficacy ($\varphi = .49$) and professional (BSWE, $\varphi = .56$) self-efficacy, consistent with expectations that a domain-specific belief is relat ed to, yet distinct from, broader efficacy beliefs; any alignment with hierarchical accounts is ancillary to the scale's validation aim (Chen et al., 2001b; Scholz et al., 2002). At

the same time, it proved to be distinct from external stressors such as role conflict ($\varphi = -.31$) and maladaptive coping strategies such as ISG, confirming it captures an internal, agentic belief rather than environmental pressures or behavioural outcomes (Mustafić et al., 2023; Rizzo et al., 1970).

What makes these findings particularly significant is the scale's predictive power. SWE-E showed strong relationships with vitality ($\varphi = .60$) and all three facets of work fatigue. More importantly, it explained a substantial portion of the variance in these energetic outcomes even after accounting for both general and professional/occupational self-efficacies. This incremental validity, which added between 12% and 20% to the explained variance, is a powerful, real-world demonstration of Bandura's (2006) notion of specificity. The results clearly show that to understand an employee's energetic state, it is far more effective to measure their specific confidence in managing that energy than it is to measure their confidence in a broader sense (Bandura, 2006).

Theoretical and Research Implications

The primary theoretical contribution of this study is its clear, empirical reinforcement of the value of domain-specific measurement in predicting energy-related outcomes. The findings offer a concrete affirmation of the specificity principle, a cornerstone of SCT, and suggest that addressing the "human energy crisis" requires a focus on building the internal, agentic beliefs that empower individuals to navigate workplace demands effectively (Onyemelukwe et al., 2023). By validating a measure of an agentic belief that precedes behaviour, this study helps connect the dots in the dynamic of triadic reciprocal causation (Bandura, 2001; Wood & Bandura, 1989). In other words, it provides a tool to explore how an employee's confidence (a personal factor) might influence their use of restorative strategies (a behaviour), which in turn shapes their experienced well-being (an outcome).

This work also adds a crucial piece to the existing energy management literature. Much of the prior research has focused on cataloguing effective energy management behaviours, including taking micro-breaks or proactively structuring tasks (Albulescu et al., 2022; Op den Kamp et al., 2018). This study shifts the focus to a fundamental psychological antecedent of those behaviours. Confidence may be the unifying factor that empowers individuals to translate their knowledge of such strategies into effective action. SWE-E therefore provides a theoretical bridge, suggesting it is a key mechanism in the process of successful energy self-regulation.

Practical Implications

The validation of the SWE-E scale offers concrete, actionable insights for organisations. As a brief and precise diagnostic tool, it can help identify employees or teams at risk of energetic depletion who would benefit most from targeted support. Its grounding in SCT also provides a clear, evidence-based roadmap for designing interventions based on Bandura's (1977) four sources of self-efficacy. For instance, organisations can foster mastery experiences through targeted training programmes that have been shown to improve recovery-related self-efficacy and well-being, such as those focused on learning how to detach from work stress (Hahn et al., 2011). To facilitate vicarious experiences, organisations could consider implementing peer mentoring systems where employees collaborate and share their successful energy management strategies (Wood & Bandura, 1989). By being trained in verbal persuasive techniques, supervisors can provide social support and elevate their subordinates' confidence in their ability to manage their energy (Ghani et al., 2024). Lastly, organisations can offer evidence-based stress-reduction programmes to facilitate employees manage their physiological and emotional states by offering evidence-based stress reduction programmes (Green et al., 2017). The scale's brevity makes it ideal for integration into digital health platforms, allowing for scalable, personalised support.

Strengths, Limitations, and Future Research

This validation study's rigorous methodological choices translate into a few of its strengths. Firstly, its large sample size provided ample statistical power (Bagozzi & Yi, 2011). Also, its comprehensive validation approach consistently aligned with the best current practices (Cheung et al., 2023). Discriminant checks showed SWE-E is empirically distinct from stressor and behaviour constructs, reducing redundancy concerns. However, some limitations must be considered. First, the German-speaking sample limits the generalisability of the findings to other cultural contexts where norms around work and well-being may differ (Scholz et al., 2002). Second, the reliance on self-report data introduces the potential for common method variance, though the strong discriminant validity results help to mitigate this concern (Kline, 2023).

Despite the stringent measures taken to account for any extraneous factors, the use of a cross-sectional design implies that causations cannot be inferred (Spector, 2019). Notwithstanding this issue, the primary aim of this study was validation, establishing reliable associations within a nomological network as predicted by theory, rather than causal testing. While the findings are consistent with SCT-based expectations, it is also plausible that reciprocal relationships exist; for instance, chronic work fatigue may erode self-efficacy over time (Wood & Bandura, 1989).

These limitations point toward a clear agenda for future research. Longitudinal and diary studies are needed to untangle the causal and reciprocal relationships between SWE-E and energetic outcomes over time, building on the preliminary work of Köhlmann (2023). Intervention studies are also a critical next step to test whether programmes designed to boost SWE-E lead to tangible improvements in well-being (Kline, 2023). Finally, validating the scale across diverse cultural and occupational settings will be essential to confirm its broader utility (Barahona et al., 2018; Kline, 2023).

Conclusion

This study addressed a critical gap in occupational health psychology: the paucity of validated instruments to measure an employee's belief in their ability to manage their personal energy. The evidence shows that the SWE-E scale appropriately addresses this gap. This research provides the first rigorous empirical validation of the SWE-E scale, establishing it as a short, reliable, and valid instrument with strong predictive and incremental validity for key well-being outcomes. By confirming the superiority of a domain-specific measure, this work offers a robust, real-world affirmation of the specificity principle, a cornerstone of SCT (Bandura, 1977, 2006).

The significance of this work, however, extends beyond psychometrics. The "human energy crisis" represents a critical challenge for modern organisations, carrying substantial well-being and economic costs (Onyemelukwe et al., 2023). The findings from this study suggest that a more complete approach must also consider the internal, agentic beliefs that enable for measuring this core belief. It lets researchers model self-regulation more precisely and helps practitioners target interventions that build psychological capital. By aligning with current organisational agendas around psychological health and safety, the use of such a tool can contribute to building healthier, more productive, and more humane workplaces.

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Appendix A: Variables from Dataset

Table A1

List of All Scale Items by Construct

Construct	Item Code
Energy Management Self-Efficacy (SWE-E)	swee1, swee2, swee3, swee4, swee5
General Self-Efficacy (SWE)	swe01, swe02, swe03, swe04, swe05, swe06, swe07, swe08, swe09, swe10
Professional Self-Efficacy (BSWE)	bswe1, bswe2, bswe3, bswe4, bswe5, bswe6, bswe7, bswe8
Role Conflict (RK)	rk1, rk2, rk3, rk4, rk5, rk6, rk7, rk8
Vitality (VIT)	vit1, vit2, vit3, vit4, vit5, vit6, vit7
Work Fatigue - Physical (WFI-P)	wfi_p1, wfi_p2, wfi_p3, wfi_p4, wfi_p5, wfi_p6
Work Fatigue - Mental (WFI-M)	wfi_m1, wfi_m2, wfi_m3, wfi_m4, wfi_m5, wfi_m6
Work Fatigue - Emotional (WFI-E)	wfi_e1, wfi_e2, wfi_e3, wfi_e4, wfi_e5, wfi_e6
Self-Endangering Work Behaviour (ISG)	
Work-private life conflict (VAF)	isg_vaf1, isg_vaf2, isg_vaf3, isg_vaf4
Squeezing out breaks (SQZ)	isg_sqz1, isg_sqz2, isg_sqz3, isg_sqz4
Presenteeism (P)	isg_p1, isg_p2, isg_p3, isg_p4
Sickness (SK)	isg_sk1, isg_sk2, isg_sk3, isg_sk4
Neglecting safety regulations (AF)	isg_af1, isg_af2, isg_af3, isg_af4
Decline in quality (DSQ)	isg_dsq1, isg_dsq2, isg_dsq3, isg_dsq4
Impairment-avoiding ambition (IAA)	isg_iaa1, isg_iaa2, isg_iaa3, isg_iaa4
Overtime (VT)	isg_vt1, isg_vt2, isg_vt3
Annual leave (VAA)	isg_vaa1, isg_vaa2, isg_vaa3
Neglecting social contacts (VP)	isg_vp1, isg_vp2, isg_vp3

Note. This table lists all individual items referenced in the study's analyses.