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## A meta-analysis

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# Antecedents and outcomes of work-related flow: A meta-analysis

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ABSTRACT

Flow is an optimal state that contributes positively to individual well-being and performance. Despite growing evidence of its antecedents and outcomes at work, few efforts have been made to systematically examine and synthesize the extant findings to advance the theoretical and empirical development of flow. Combining different perspectives (e.g., job demands and resources theory, proactivity and leadership literatures), we aim to identify the key antecedents and outcomes relevant to work-related flow, and (a) provide a nomological network and (b) spot areas for future research on flow. We conducted a meta-analysis to synthesize findings ($N = 60{,}110$, $k = 113$). Results showed that several factors, including job characteristics, individual characteristics, individual behaviors, and leadership characteristics were significantly related to flow. Individual behavior displayed the strongest association with flow ($\rho = 0.55$). In addition, flow was not only related to job outcomes but also to personal outcomes. We also investigated the relative contribution of sub-dimensions of flow to well-being and performance. The relationships between flow and its associates hold across different measures of flow and culture. Our findings suggest that employees can use more proactive strategies to foster flow rather than only respond to their environment. Despite the short-run side effects of flow (e.g., risk-taking behavior), flow is worth pursuing in the long run as it benefits both work and personal well-being. We encourage future flow studies to investigate additional social and situational factors and various types of proactive behaviors in a multilevel process.

Flow refers to a state in which people are immersed in the task at hand, feel intrinsically motivated, and experience a sense of control (Csikszentmihalyi, 1997). To illustrate, Csikszentmihalyi in the 1970s interviewed productive and creative individuals, including Nobel Prize winners and the greatest athletes, and found that the ability to enter flow deliberately, was an important factor that accounts for their optimal performance (Souders, 2020). Since then, the concept of flow has consistently attracted scholarly attention for decades. Although flow, in principle, can occur in any task, it is often being studied in relation to work.

Work-related flow is defined as an optimal state that comprises work absorption, work enjoyment, and intrinsic work motivation (Bakker, 2008). The importance of flow for organizational outcomes and individual well-being and performance has been addressed in previous studies (for a review, see Fullagar & Delle Fave, 2017), which have revealed various antecedents and outcomes of work-related flow. Examples of antecedents of flow include skill-challenge balance (Asakawa, 2004b; Engeser & Rheinberg, 2008), job resources (e.g., autonomy, feedback; Oerlemans & Bakker, 2018), personal resources (Debus et al., 2014; Salanova et al., 2006),

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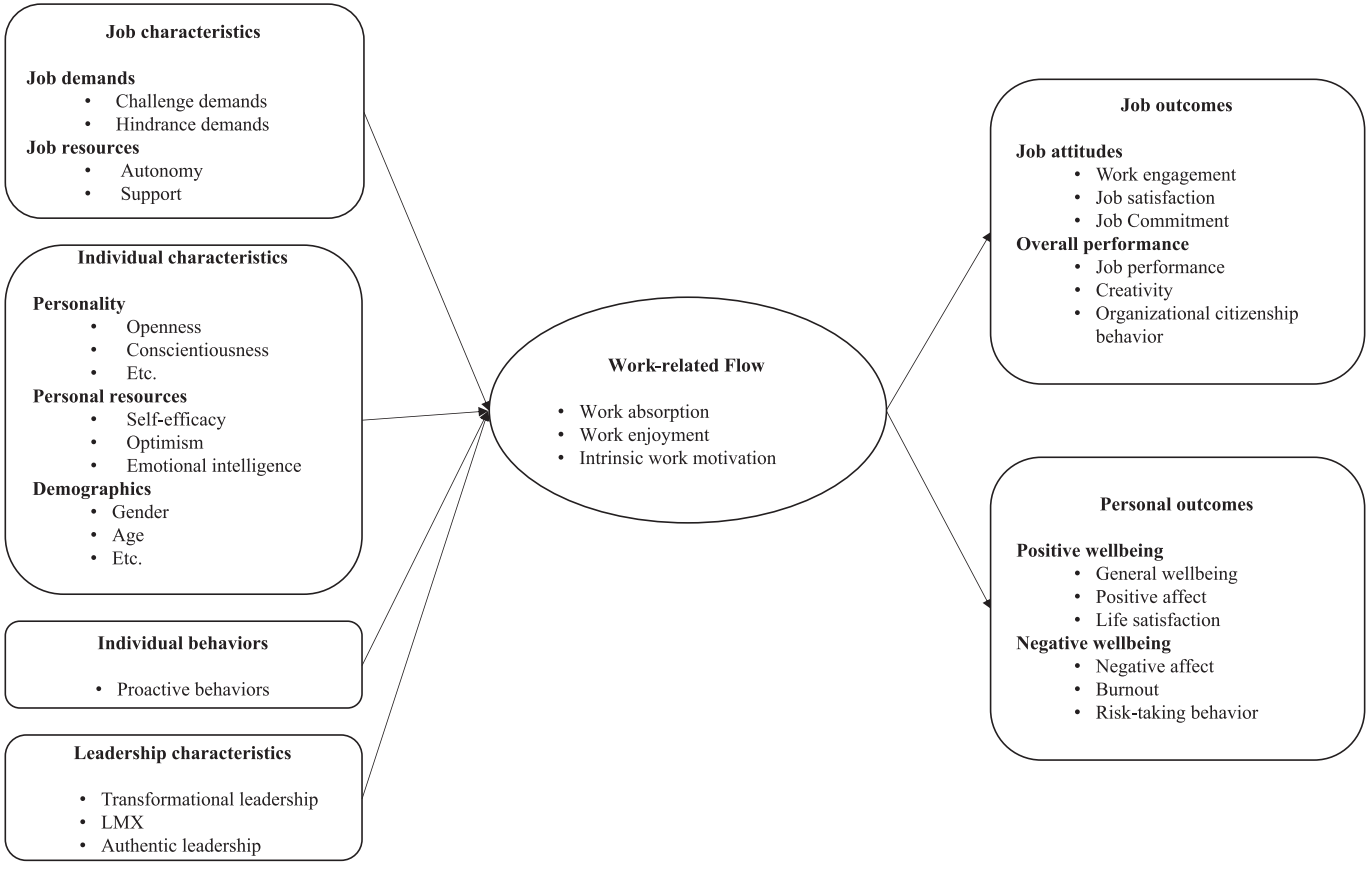


**Fig. 1.** Proposed nomological network of work-related flow.

personality (Ullén et al., 2012), and leadership (Linsner, 2009; Zubair & Kamal, 2015). Outcomes of work-related flow that have been identified are positive affect (Asakawa, 2004a; Rogatko, 2009), life satisfaction (Bassi et al., 2014), risk-taking behavior (Liu et al., 2021; Schüler & Nakamura, 2013), and job performance (Demerouti, 2006; Engeser & Rheinberg, 2008; Landhäußer & Keller, 2012).

A prominent way of viewing the antecedents of flow in prior literature is to consider flow as a "passively" determined state (Bakker & Van Woerkom, 2017), implying that flow is depended upon job and individual characteristics over which people have little control. Job characteristics refer to external job conditions such as job demands and resources (Bakker et al., 2023). Individual characteristics refer to the internal states and conditions related to oneself, such as personality and stable personal resources (e.g., self-efficacy) (Tracey et al., 2001). However, an emerging stream of research on proactivity suggests that work-related flow may not only be dependent on job characteristics, but rather also depend on individual employee behaviors (Bakker et al., 2019; Bakker & Van Woerkom, 2017; Liu et al., 2021; Op den Kamp et al., 2018). Despite this, few efforts have been made to integrate these findings into the flow literature and compare the effectiveness of various antecedents of flow (e.g., job demands and resources, individual behaviors). Previous qualitative and meta-analytic reviews of flow mainly focused on one aspect of flow or otherwise a limited selection of flow correlates, such as skill-challenge balance (Fong et al., 2015), antecedents of flow (Nicol, 2017), conceptualization (flow vs. engagement; Farina et al., 2018), measurement of social flow at work (de Moura & Porto Bellini, 2019), and neurological mechanisms underlying flow (Van der Linden et al., 2021). One article looked at the antecedents and outcomes of flow, but that was a qualitative review (Peifer & Wolters, 2021), which limits the conclusions that can be drawn from it.

Given the state of the knowledge on flow, a meta-analysis of flow incorporating a relevant range of its antecedents and outcomes can be considered relevant and timely, through which we aim to: (a) promote theoretical and empirical advancement of flow by synthesizing the extant findings from different perspectives related to flow, thereby providing a nomological network of flow acting as a theoretical foundation for work-related flow research; (b) identify the underdeveloped areas within different categories and play as a roadmap for advancing flow research, aiming to provide a clear guidance of important and promising directions for future research; (c) offer practical and empirical implications by comparing the size of effects and providing quantitative estimates of the relationships between flow and a range of relevant antecedents and outcomes. This information can be used to create more concrete organizational and personal strategies that will facilitate flow experience.

To these ends, we thoroughly examined the findings of flow from different and diverse perspectives in a cohesive way, including job demands-resources (JD-R) theory (Bakker et al., 2023), the self-determination model of flow (Bakker & Van Woerkom, 2017), proactivity literature (Grant & Ashford, 2008), personality (Gosling et al., 2003), leadership (Zubair & Kamal, 2015), and consequences of flow (Demerouti, 2006; Liu et al., 2021). We conducted a meta-analysis to calculate the effect sizes of flow associates, compared their relative strengths/magnitude, and clarified opportunities for future research. We thoroughly searched the literature and conducted a meta-analysis that included 113 studies and comprised 60,110 participants.

The current study makes three contributions to the flow literature. First, as flow emerged as an essential concept from different theories and perspectives, we provide a nomological network by examining and synthesizing the extant findings of flow. This offers a timely and complete understanding of the essential associates including antecedents, outcomes and moderators of flow, and categorizes them based on relevant broad classifications (see Fig. 1), which expands previous reviews and provides a solid foundation for future flow research. Second, we identify the underdeveloped but critical areas related to flow and provide clear directions for future research. For example, we identify the limitations and challenges and raised the following areas that can be further investigated: (a) a variety of other types of antecedents based on the category and limited number of observations, (b) research design that can better reflect the nature of flow (e.g., episodic level) as well as the causal relationship between flow and its associates, and (c) investigate flow in a team context and as a multilevel process. Third, we provide a series of functional and practical contributions to the flow areas by (a) comparing the associations and size effects between flow associates, (b) calculating the relative contribution of sub-dimensions of flow when predicting flow outcomes (Tonidandel & LeBreton, 2015), and (c) investigating the boundary conditions in terms of flow measures and national culture (Moneta, 2004). These diverse analyses and approaches provide a more fine-grained picture on the flow network, and will be useful for practitioners (e.g., leaders, employees) because they help identify when, how, and what to do to foster flow.

In the following sections, we first present an overview of the conceptualization and measures of flow. Then we systematically sort out the antecedents and outcomes and formulate our hypotheses. Subsequently, we describe the methods in literature search and coding procedures. Finally, we discuss the implications, limitations, and directions for future research.

## 1. Theoretical background and hypotheses

### *1.1. Conceptualizations of work-related flow*

The seminal work of flow dates back to Csikszentmihalyi's research on creativity in the 1970s. Csikszentmihalyi (2020) was fascinated by the fact that individuals, including mountain climbers, artists, and musicians, tended to do activities by which they reached excellence and creativity. Interviews with these talented individuals revealed that, during their peak performance, a fluid process occurred that can be described as "playful effort and concentration, as like being carried along on a stream of water" (Fullagar & Delle Fave, 2017, p. 5). Prior to Csikszentmihalyi, several humanistic psychologists – including Maslow (1965) and Rogers (1963) – had coined similar concepts, such as "peak experience" and "fully functioning." Since the 1970s, flow research has unfolded since it is closely related to well-being and performance (Asakawa, 2004a; Bakker, 2008; Bassi et al., 2014).

According to Csikszentmihalyi (1997), one of the hallmarks of flow is the autotelic experience, which is often generated from self-directed activities with meaning and clear goals. Individuals have a lower level of self-awareness and are entirely absorbed by the task

**Table 1**
Conceptualization and measures of work-related flow.

| Variable | Conceptualization | Measures | Items |
|---|---|---|---|
| Overall flow | 1. Intense and focused concentration on what one is doing in the present moment.<br>2. Merging of action and awareness.<br>3. Loss of reflective self-consciousness (i.e., loss of awareness of oneself as a social actor).<br>4. A sense that one can control one's actions; that is, a sense that one can in principle deal with the situation because one knows how to respond to whatever happens next.<br>5. Distortion of temporal experience (typically, a sense that time has passed faster than normal).<br>6. Experience of the activity as intrinsically re-warding, such that often the end goal is just an excuse for the process.<br>7. Appropriate level between challenges and one's capacities/skills<br>8. Clear proximal goals.<br>9 Immediate feedback about the progress that is being made.[a] | Flow Questionnaire (FQ; Csikszentmihalyi & Judith, 1989).<br>Experience Sampling Form (ESF; Csikszentmihalyi, 1997): 42 items.<br>Flow State Scale-2 (FSS-2), and Dispositional Flow Scale-2 (DFS-2) by Jackson and Eklund (2002): 36 items.<br>Flow Short Scale by Rheinberg et al. (2003; cf. Engeser & Rheinberg, 2008): 10 items.<br>Swedish Flow Proneness Questionnaire (SFPQ; Ullén et al., 2012). | e.g., How well were you concentrating?<br>e.g., I am completely focused on the task at hand.<br>e.g., I feel just the right amount of challenge. |
| Work-related flow | 1. Work absorption refers to a complete immersion and absorption on the task at hand.<br>2. Work enjoyment means that work-related tasks are enjoyable, provide a good feeling, and employees tend to feel happy.<br>3. Intrinsic work motivation points to that people conduct job tasks for its own sake rather than for extrinsic rewards (e.g., money). The tasks are interesting in themselves. | WOrk-reLated Flow Inventory (WOLF; Bakker, 2008): 13 items.<br>Work dimension of Swedish Flow Proneness Questionnaire (SFPQ; Ullén et al., 2012) and sub-dimensions of Utrecht Work Engagement Scale ( Schaufeli et al., 2006). | e.g., My work gives me a good feeling.<br>e.g., When do you do something at work, how often does it happen that you feel bored? |

[a] To measure overall flow, Engeser and Rheinberg (2008) and Jackson and Eklund (2002) include 9 dimensions; whereas other authors include 6 dimensions.

at hand when experiencing flow. Capturing such attributes, Csikszentmihalyi (1997) characterized flow with nine characteristics including: (1) fusion of action and consciousness, (2) high level of focus or concentration, (3) low level of self-awareness, (4) feeling of being in control, (5) clear goals, (6) feedback, (7) autotelic experience that is self-rewarding, (8) altered sense of experiencing time, and (9) experienced balance between skill and challenge. It has been argued that some of these flow aspects, such as clear goals, feedback, and skill-challenge, are better positioned as predictors of flow because they likely foster flow rather than being experienced during the state flow itself (see Table 1; Nakamura & Csikszentmihalyi, 2014).

Flow is highlighted as a critical phenomenon in the work context, given its strong connection with job performance and well-being. Bakker (2008) conceptualized work-related flow as a short-term state characterized by three essential pillars: work absorption, work enjoyment, and intrinsic work motivation (see Table 1, for more details). Csikszentmihalyi and Judith (1989) indicated that flow might occur more often during work rather than leisure time. Because at work, individuals often need to seek feedback or support to deal with challenges, develop themselves, and achieve a sense of meaningfulness (Csikszentmihalyi, 2020). A similar concept that is related to, but different from flow is work engagement. Flow is different from work engagement as flow is defined as a more *short-term* state and experience characterized by its transient and volatile nature (Ceja & Navarro, 2012).

### 1.2. Antecedents of work-related flow

Several theoretical models have been used to explain the antecedents of work-related flow, including the job demands and resources (JD-R) theory (Bakker et al., 2023), job characteristic theory (JCT; Hackman & Oldham, 1976), and the self-determination model of flow (Bakker & Van Woerkom, 2017). JD-R has indicated that job resources, such as social support and autonomy, are positively related to better functioning and engagement at work. Similarly, JCT suggests that motivating job features are associated with optimal functioning and job performance. Studies have shown that motivating job characteristics (e.g., skill variety, task significance) facilitate flow-like experience (Fullagar & Kelloway, 2009; Oerlemans & Bakker, 2018). In addition, personality, proactivity, and leadership literature have examined flow not only from a between-person perspective (e.g., cross-sectional studies) but also from within-person perspectives (e.g., experience sampling method; Schermuly & Meyer, 2020; Ullén et al., 2012; Xanthopoulou et al., 2012). Combining these theoretical models and literature, we divided the flow antecedents into four broad categories, including job characteristics, individual characteristics, individual behaviors, and leadership characteristics. These categories can help realize the study aims by comparing effects between and within categories, and identifying potential variables that can be further investigated within each broad category.

#### 1.2.1. Job characteristics

According to JD-R theory (Bakker et al., 2023), in the work environment, job characteristics can be classified into two main subcategories, including job demands and job resources. Job demands refer to "those physical, social, or organizational aspects that require sustained physical or mental effort and are associated with psychological and physical costs (e.g., exhaustion, stress)" (Bakker et al., 2023). It has been suggested that job demands include challenge demands and hindrance demands (Lepine et al., 2005). Challenge demands refer to the job aspects that can facilitate personal growth and gain, require efforts/energy, and inspire and motivate (e.g., work complexity; Lepine et al., 2005). Hindrance demands are the stressing job aspects that deplete cognitive resources, thwart personal growth and goal attainment (e.g., family conflict, role ambiguity, and hassles; Van Oortmerssen et al., 2020). In contrast, job resources refer to the physical, psychological, and social aspects that help employees to achieve work-related goals and personal growth (e.g., feedback, social support; Habe & Tement, 2016).

According to JD-R theory, the extent to which job demands positively or negatively impact flow depends on whether the demands are perceived as challenges or hindrances (Habe & Tement, 2016; Nielsen & Cleal, 2010). Challenge demands may inspire and motivate employees to develop themselves and grow by satisfying their needs on competence (Ilies et al., 2017). In contrast, hindrance demands may undermine optimal functioning because they relate to rumination, conflicts, and negative thoughts (Lepine et al., 2005). For example, Van Oortmerssen et al. (2020) revealed a positive association between challenge demands and flow and a negative association between hindrance demands and flow. Job resources tend to boost flow as they provide individuals with support and feedback to deal with demands and challenges (Mäkikangas et al., 2010). Job resources have been highlighted as essential factors to foster optimal functioning at work (Habe & Tement, 2016). The underlying mechanisms might be that job resources enable individuals to better deal with job challenges as they have more solutions (e.g., suggestions, support) for problems. Empirical evidence has shown that job resources were positively associated with personal resources and flow (Debus et al., 2014; Demerouti, 2006; Habe & Tement, 2016; Mäkikangas et al., 2010).

**Hypothesis 1**. Challenge demands (H1a) and job resources (H1b) are positively related to flow. Hindrance demands (H1c) are negatively associated with flow.

#### 1.2.2. Individual characteristics

*1.2.2.1. The Big Five of personality.* Several personality concepts have been highlighted in the literature to describe individual differences in flow, such as dispositional flow (Jackson & Eklund, 2002) and flow proneness (Ullén et al., 2012). Most research on the relationship between personality and flow proneness/experience has been conducted using the Big Five framework of personality (Bakker et al., 2019; Demerouti, 2006; Zager Kocjan & Avsec, 2017).

The Five-factor model includes Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (OCEAN; Goldberg,

1990). Openness to experience implies that individuals are eager to explore the unknown. Conscientiousness refers to being generally well-organized, careful, thorough, and goal-oriented. Conscientiousness allows employees to completely engage in tasks because they conduct job tasks in a meticulous manner. Extraversion refers to the tendency to be self-confident, dominant, active, and excitement-seeking. Extraverted individuals get access to social resources and show more energetic behavior. A person with a high level of agreeableness is usually warm, friendly, tactful, and prosocial (Graziano & Eisenberg, 1997). Agreeable people often get along with others well. In contrast, neuroticism may undermine flow as it is usually associated with volatile moods and feelings such as anxiety, worry, and frustration (Bakker et al., 2019). Research has demonstrated that individuals who possess certain personality traits tend to be more responsible in their work, acquire more social resources, and have good interpersonal relationships with others (Bakker et al., 2019; Demerouti, 2006),indicating their social effectiveness. This notion is consistent with recent findings that the tendency to experience flow is substantially correlated with a general factor of personality, which presumably captures social effectiveness in the Big-Five personality inventory (Dunkel et al., 2022).

**Hypothesis 2**. Openness (H2a), conscientiousness (H2b), extraversion (H2c), and agreeableness (H2d) are positively related to flow. Neuroticism (H2e) is negatively related to flow. H2f: personal resources are positively related to flow. H2g: demographics, including gender, age, education, and tenure, are significantly related to flow.

*1.2.2.2. Personal resources.* Personal resources are considered crucial for promoting resiliency and a sense of control over one's circumstances (Salanova et al., 2006). Research has shown that personal and job resources are reciprocally related in an up-spiral, and both are positively associated with flow-like experience (Xanthopoulou et al., 2009). Furthermore, personal resources such as self-esteem, optimism, and self-efficacy have been identified as key factors facilitating optimal functioning (Bakker et al., 2023). Several studies have confirmed the role of personal resources in promoting flow (Debus et al., 2014; Salanova et al., 2006; Xanthopoulou et al., 2009).

*1.2.2.3. Demographics.* Demographics such as gender, age, and tenure have been associated with flow experiences. For example, Bryce and Haworth (2002) found that gender differences exist in the activities to facilitate flow. Age might affect flow experiences (Sharafi et al., 2006). Educational level may also entail one's cognitive ability and skill sets, which may be related to the flow experienced with job tasks. Furthermore, as employees gain more work experience (i.e., tenure) grows, they may develop their skills and become more engaged in their work, which is essential for experiencing flow (Csikszentmihalyi, 1997).

### *1.2.3. Individual behaviors*

Apart from the JD-R model, another stream of research suggests that individuals can proactively change their environment or personal state to enhance the likelihood of experiencing flow at work (Bakker & Van Woerkom, 2017; Liu et al., 2021). In general, proactive behaviors refer to personal initiative to take charge of, or change conditions in a desirable direction, and to facilitate person-environment fit and personal development (Parker et al., 2019). According to the self-determination model of flow (Bakker & Van Woerkom, 2017), employees can use four different proactive strategies to *create* flow: self-leadership, job crafting, strengths use, and playful work design. These behaviors can help individuals satisfy their basic needs, promote flow experiences, and, consequently, enhance job performance (Bakker & Van Woerkom, 2017, p. 47).

Proactive behaviors consist of various strategies, including taking charge, seeking feedback, problem prevention, and vigor management (Grant & Ashford, 2008). Despite evidence on possible negative side-effects of proactivity (e.g., depletion of energy), proactive behaviors have been consistently been related to positive work outcomes such as career success, optimal functioning, and performance (for a review, see Parker et al., 2019). For example, playful work design (a behavioral orientation that designs work with more fun and challenge) was demonstrated to be positively related to an engaged state at work (Bakker & Van Woerkom, 2017). Strengths use (doing the things/activities one is good at) was shown to facilitate flow (Liu et al., 2021), and proactive vitality management was positively related to flow-like experiences (Op den Kamp et al., 2018).

**Hypothesis 3**. Proactive behaviors are positively related to flow.

### *1.2.4. Leadership characteristics*

Leadership refers to the relationship and style of interaction between employers and their employees (Zubair & Kamal, 2015). Leadership style is highlighted in the workplace because it influences individual and organizational outcomes. The leadership literature has indicated that leadership styles and how leaders interact with followers are related to their followers' working states (Judge & Piccolo, 2004). Several leadership styles have been related to employee flow, including transformational leadership, which refers to providing inspirational motivation, intellectual stimulation, and individual consideration, as well as an idealized influence (Judge & Piccolo, 2004), leadership-member exchange (LMX), referring to the in-group and out-group exchange relationship between leaders and subordinates in terms of material and non-material goods (Liden et al., 1997), and authentic leadership, which emphasizes honest relationships with followers who truthfully value leaders' inputs and beliefs (Avolio & Gardner, 2005).

According to Bass (1999), transformational leadership provides subordinates with intellectual support, considerate care, and inspiration. Under this circumstance, subordinates try to grow and develop themselves rather than solely to satisfy job requirements from leaders, which, in turn, facilitate functioning and dedication at work. Leaders or members with high-quality LMX are likely to form a stronger relationship and consolidate their cooperation, bringing more emotional and social support to employees (Aydin Kucuk, 2020). Authentic leadership emphasizes that leaders build grounded connections with associates by exerting greater efforts and

self-regulated behaviors. Authentic leaders direct associates through their beliefs, values, and actions rather than put orders or force their employees to do something (Avolio & Gardner, 2005). It has been illustrated that these positive leadership styles are beneficial to flow (Linsner, 2009; Schermuly & Meyer, 2020; Zubair & Kamal, 2015).

**Hypothesis 4**. Leadership (i.e., transformational leadership, LMX, authentic leadership) is positively related to flow.

### *1.3. Outcomes of work-related flow*

The flow experience may benefit both work-related and personal outcomes (Demerouti et al., 2012). According to the spillover-crossover model (Bakker & Demerouti, 2013), negative and positive experiences during work can be transferred and extended from the work domain to the family domain. Spillover is defined as "a within-person, across-domains transmission of demands and consequent strain from the work domain to the nonwork domain" (Bakker et al., 2014, p. 64). It has been shown that positive work experiences such as work engagement can have a positive impact on employees' private lives (Bakker et al., 2014). Since flow is a positive state of mind characterized by cognitive and motivational elements, it can be expected that the flow experience can be carried over to private life and have an impact outside of work. Drawing on the literature of flow outcomes and the spillover-crossover model, we organized the flow outcomes into two broad categories, including job-related outcomes and personal outcomes. The job-related outcomes refer to the feelings, thoughts, and performance in the work domain, such as job attitudes and performance (Howard et al., 2020). Personal outcomes refer to context-free feelings and behaviors and may involve positive well-being (e.g., life satisfaction, positive affect) and negative wellbeing (e.g., negative affect, burnout, risk-taking behavior).

#### *1.3.1. Job-related outcomes*

Flow may be positively related to job-related outcomes because during flow, individuals tend to optimally mobilize their attentional resources, become intrinsically motivated, and feel more engaged in their job tasks. According to JD-R theory, work engagement is defined as a work-related and fulfilling state that is composed of vigor, absorption, and dedication (Bakker et al., 2023). Although work engagement may also fluctuate at a within-person level (Xanthopoulou et al., 2012), one essential dimension of work engagement is vigor, which refers to *physical* aspects such as energy. Yet, flow concerns psychological rather than physical states/experiences such as merging with the tasks at hand and ignorance of surrounding stimuli (cf. Bakker, 2008). In fact, using a series of studies, Van Ittersum (2015) has shown that work engagement is a related but distinct factor with flow.

When faced with challenges, people mobilize their attentional resources to the targeted tasks (De Sampaio Barros et al., 2018), resulting in deep involvement in the tasks at hand. This brings employees into full play because they tend to use their full potential, which benefits their work engagement and performance. Job satisfaction refers to the overall affective and cognitive evaluation of one's working conditions (Zhu, 2013). Intrinsically rewarding experiences at work (e.g., enjoyment, interesting challenges, achievement) have been proposed to lead to a higher level of job satisfaction (Maeran & Cangiano, 2013). Studies have empirically shown that flow is positively related to job satisfaction (De Freitas et al., 2019; Ilies et al., 2017; Landhäußer & Keller, 2012). In addition, people seek and meet challenges during flow, this helps them fulfill and satisfy personal needs such as competence (Ryan & Deci, 2000). The sense of fulfillment and satisfaction, which may be perceived as rewarding, in turn, reinforces individual behavioral patterns to pursue flow again (Fullagar & Delle Fave, 2017). This consistently emerging willingness to access flow may increase job commitment (Bakker et al., 2023).

Studies have revealed a positive association between flow and performance at work and in other fields such as education, sports, and music (Bakker, 2008; Csikszentmihalyi, 1997; Fritz & Avsec, 2007). As one of the core dimensions of work flow is work enjoyment, which conceptually overlaps with positive affect at work, we argue that flow (work enjoyment) and accompanied positive affect promote flexible thinking, thereby increasing creativity (e.g., originality). People develop divergent thinking and produce more original ideas when they are happier (Fredrickson, 2001). Moreover, individuals tend to be prosocial and go beyond their job requirements when they feel positive in the manifestation of organizational citizenship behavior (OCB) (Peifer & Wolters, 2021). Aknin et al. (2018) have shown that positive feelings (e.g., reward) have an positive impact on social behavior by broadening an individual's mindset.

**Hypothesis 5**. Flow is positively related to work engagement (H5a), job satisfaction (H5b), job commitment (H5c), job performance (H5d), creativity (H5e), organizational citizenship behavior (H5f).

#### *1.3.2. Personal outcomes*

Flow is often accompanied by positive affect, and individuals tend to experience more positive affect after flow (Csikszentmihalyi, 1997), allowing them to feel happier and satisfied outside their work (Demerouti, 2006). According to the spillover-crossover theory (Bakker & Demerouti, 2013), positive experience (e.g., flow) at work can be extended and have a positive impact on individuals' and their partner's experiences at home. That being said, flow at work has the potential in facilitating general positive affect and well-being. It has been shown that flow is positively related to life satisfaction (Bryce & Haworth, 2002), vigor at home (Demerouti et al., 2012), and general well-being (Fritz & Avsec, 2007). Also, the deep focus accompanied by flow leaves a limited capacity to develop ruminative and depressive thoughts, which helps individuals reach healthier mental and physical states. Flow is related to a decreased level of exhaustion and negative emotions (Xanthopoulou et al., 2012). This is because, although flow may consume cognitive resources (e.g., attention), it can also replenish and produce personal resources (e.g., confidence). This might counterbalance negative feelings such as fatigue and burnout (Van Ittersum, 2015). Although flow is transient and short-lived, studies have shown that flow can be motivating and energizing in the long run (Csikszentmihalyi, 2000; Salanova et al., 2006), and is beneficial for individual

physical health (Hirao et al., 2012). Similarly, Aust et al. (2022) showed that flow was negatively related to burnout symptoms.

Flow may not necessarily be all sunshine and rainbows, but may also have its "dark sides". Flow sometimes is addiction-like because this experience is very rewarding (Csikszentmihalyi, 1997). The deep and complete involvement characteristic of flow may cause side-effects because people may experience difficulties getting out of flow. As such, flow may deplete energy and cognitive resources due to intense focus and concentration in the short run (e.g., at an episodic level). Newton et al. (2020) found that participants felt it was challenging to switch across tasks, and performed worse after a task in which they felt immersed. Similarly, Liu et al. (2021) found that employees tend to perform worse in a Stroop Color and Word Test after the work episode during which they experienced flow. The less attentional resources may impair individuals' ability to make accurate judgements and make them under estimate the potential risks. Flow has also been linked to unethical behavior (Aleksić, 2016), risk-taking behavior (Liu et al., 2021; Schüler & Nakamura, 2013), and addiction (Csikszentmihalyi, 1997).

**Hypothesis 6**. Flow is positively related to well-being (H6a), life satisfaction (H6b), positive affect (H6c), risk-taking behavior (H6d). Flow is negatively associated with negative affect (H6e), and burnout (H6f).

### *1.4. Moderators: cultural differences and flow measurement*

The literature has indicated that individuals from various cultures may encounter different optimal conditions for entering flow (Moneta, 2004). For example, Moneta found that, compared to U.S. students, the skill/challenge ratio is more biased towards skills for Chinese students. Chinese students tend to experience the highest level of flow in high-skill/lower-challenge conditions rather than in a typical high-skill/high-challenge condition. Although Moneta's findings are limited to student samples, other scholars have echoed this finding or suggested the East-West cultural differences in flow experiences (Markus & Kitayama, 1991; Oishi et al., 1999). Accordingly, it is useful to take into account the cultural background as a possible moderator.

#### *1.4.1. Flow measures*

Another aspect that could potentially influence the strength or direction of flow associates is the type of flow measurement. Several instruments have been introduced to measure flow. The Flow Questionnaire (FQ; Csikszentmihalyi & Judith, 1989) was used to describe the situations and activities in which participants experience flow. Later, the Experience Sampling Form (ESF; Csikszentmihalyi, 2020) was developed to measure the "pulse" of flow ecologically by assessing the specific type of activity, the context of the activity, and the affective and motivational experiences during activities. Other well-known instruments are the Flow State Scale-2 (FSS-2) and the Dispositional Flow Scale-2 (DFS-2) (Jackson & Eklund, 2002). Jackson and Eklund assessed flow at the trait and state level and tried to measure each specific component of flow (e.g., demands-skill balance, clear goals). Relatedly, Rheinberg et al. (2003) developed a Flow Short Scale to measure flow more straightforwardly. In the work context, the most used measurement is the WOrk-reLated Flow Inventory (WOLF) introduced by Bakker (2008). The WOLF includes 13 items to assess flow concerning work absorption (4 items), work enjoyment (4 items), and work intrinsic motivation (5 items). In addition, the Swedish Flow Proneness Questionnaire (SFPQ) introduced by Ullén et al. (2012) measured flow concerning maintenance, work, and daily life (see Table 1; for a review see Fullagar & Delle Fave, 2017).

As aforementioned, the WOLF introduced by Bakker (2008) takes a relatively different approach in measuring flow compared to other measures. For example, the WOLF includes work enjoyment (positive affect) as an important dimension of work-related flow, whereas various other approaches see positive affect as outcome of flow (Asakawa, 2004a; Rogatko, 2009). In this sense, it is necessary to compare whether the average of correlations holds across different types of measures. Based on this line of reasoning, the type of flow measurement is included as another possible moderator.

**Hypothesis 7**. Culture (H7a) and flow measures (H7b) moderate the association between flow and its associates.

## 2. Method

### *2.1. Literature search and inclusion criteria*

To identify as many relevant articles as possible, we followed the "best practices of literature search" in systematic reviews and meta-analyses (Harari et al., 2020; Rudolph et al., 2020) and conducted three sets of literature searches: First, online databases: we searched Google Scholar, PsyINFO, and Web of science. For each database, we used the advanced search method by developing search strings in the fields of title, abstract, and keywords (for example, in Web of science, TS = "work-related flow" OR TS = "flow at work" OR TS = "peak experience at work" OR TS = "optimal experience at work"). Second, we conducted a citation search. We conducted a backward-search by reviewing the reference sections of recently published reviews of flow (de Moura & Porto Bellini, 2019) and searched for articles that cited Bakker's (2008) seminal paper on work-related flow. Third, we conducted a manual search of journals that published articles relating to flow at work (for specific journals, see Supplements Table A2). The included journals have been recognized as high-quality journals in the field of work and organizational psychology (see latest Journal Citation Reports, www.webofknowledge.com). After removing duplicates, this process yielded 295 articles.

For inclusion, studies must (a) be written in English; (b) include quantitative studies (reviews, case studies, interviews, and commentaries were excluded); (c) have measured predictors (e.g., autonomy, leadership, and job resources) or outcomes and work-related flow. Building on these, the second and the third author independently screened the titles and abstracts of 295 papers and found 159 potential articles. We further conducted a full manuscript screening, in which 40 articles were excluded because of the lack

of relevant data (i.e., correlation) or unavailability of the targeted paper. Finally, we included 113 papers with a total of 60,110 participants (see Fig. 2). The publication year of included studies ranged from 2003 to 2021, with the average publication year is 2015. Note that 25 out of the 113 papers were not published in peer reviewed journals or conference (e.g., master or doctoral theses). We derived the data from the university library or contacted the author.

### 2.2. Coding procedure

The first and second authors independently coded the included 113 papers. To reduce potential coding bias or copy errors, in line with the MetaBUS program (Bosco et al., 2017), we used a semi-automated procedure in which correlation tables were automatically extracted by online software (i.e., tabula; Das, 2020). We adopted such coding procedure (Bosco et al., 2017) because it enabled us to extract essential information effectively and categorize the antecedents and outcomes of flow as well as moderators, based on which we can calculate and compare the cumulative effect sizes within and across categories.

Specifically, article information, participants' information (i.e., country, sample size, gender, age), study design (i.e., measurement time points, measurement level, data sources, and reliability) were manually coded. Note that the bold labels in all tables are cluster items (e.g., Job resources, Challenge demands, Hindrance demands, Personal resources, etc.), which were derived and generalized from specific study variables. For example, "Job resources" is an umbrella term for "social support", "task freedom", and "autonomy"; "Personal resources" is an umbrella term for "self-efficacy", "coping in confidence", and "emotional intelligence" etc. (please see Supplements Table A3 for more details). We also coded culture variables based on the sample location (e.g., India, China, Japan, etc., were coded as "eastern" culture; America, Australia, Sweden, etc., were coded as "western" culture. Other types of culture (e.g., middle east, Africa) were not coded because there was a limited number of studies). All coding discrepancies between the two coders were resolved by discussion. If there were still disagreements, the third author would be involved to reconcile the codes.

### 2.3. Data analysis strategy

The current study aims to synthesize the extant findings (i.e., provide and compare effect size) and identify the conditional (i.e., moderated) relationships between flow and its associates. This means that a meta-analytical approach is appropriate. Meta-analysis can establish the common trend in a given literature when there are different or even competing effect sizes, such as providing $\bar{r}$ (sample-size-weighted mean correlation) or $\rho$ (mean score correlation), help identify untouched areas within categories (e.g., based on $k$ value), and find the moderating conditions as well as relative strength of different associations based on subgroup analysis (Rudolph et al., 2020). We used the random effects model for the meta-analysis. The random effects meta-analytic procedures were conducted by using the *R* 'metafor' package in the *R* software (Pinheiro et al., 2007). This random effects model was used as it allows for the possibility that the population parameter values differ across studies. This is especially likely because in our meta-analysis the included studies came from different subpopulations (e.g., different cultures or countries).

To test our hypotheses, we took five steps to conduct the analyses: first, we calculated the effect sizes of antecedents with flow and outcomes with flow. To provide accurate estimates, we calculated the sample-size-weighted meta-analytic correlation ($\bar{r}$). In addition, we estimated the true effect size ($\rho$) by correcting for both sample size and measurement unreliability when testing our hypotheses. The reliability score indicated by Cronbach's alpha coefficient of internal consistency reported in the original studies was used. For studies that did not report a reliability score, we used the average reliability extracted from the other studies (for instance the average reliability of flow is 0.86). Following the suggestions by Hunter and Schmidt (2004), we reported 95 % confidence intervals (CIs) of our estimated effect size. We used two indices to estimate the between-study heterogeneity: Q-test $I^2$ (i.e., percentage of variability in effects sizes that is due to true differences among the studies). A significant Q-test value indicates that the studies are heterogonous, where the $I^2 > 75$ % suggests a high heterogeneity. Some studies involved multiple samples, and reported a distinct effect size for each sample. In this case, the relevant correlations from different samples were included and treated as separate effect sizes when estimating the pooled effect sizes.

Second, when a study reported overall flow as well as separate flow dimensions (23 studies for the antecedents; 14 studies for the outcomes), we tested the overall effect of flow, and also tested how sub-dimensions of flow related to other variables. We provided the effect sizes when there were at least three studies affording us to estimate the relationships between flow sub-dimensions and their associates. Since some of our included variables did not have enough studies, we first tested the relationship between the broad categorization (i.e., umbrella term) and flow, then within the categorization, we also reported its effect size if the specific study variable (e.g., autonomy, self-efficacy) was included in three studies.

Third, we conducted the sensitivity analysis (i.e., by removing outliers and influential studies) and publication bias analysis (i.e., using egger's test, PET, PEESE, and selection models; for tutorials see: https://bookdown.org/MathiasHarrer/Doing_Meta_Analysis_in_R/pub-bias.html#selection-models). Results indicated that publication bias does not bias our results (please see Supplements Table A4). The outlier analysis (i.e., removing studies whose study's confidence interval does not overlap with the confidence interval of the pooled effect, Harrer et al., 2019) was conducted by using the "outlier" function in the "dmetar" package (Harrer et al., 2019).

Forth, we performed moderation analyses by testing whether the associations between flow and its antecedents and outcomes hold across different measures of flow and culture (i.e., sub-group analysis).

Lastly, we further conducted relative weight and subgroup analyses (Tonidandel & LeBreton, 2015) to compare the effect size between flow and its associates. These approaches help identify the relative magnitude of each association, as well as the explained variance of flow outcomes by each sub-dimension of flow. All of our data and R code are available on: https://osf.io/z3cr4/?view_only=3479f1a0ceb146d09a35c5d1f99ed6ec.

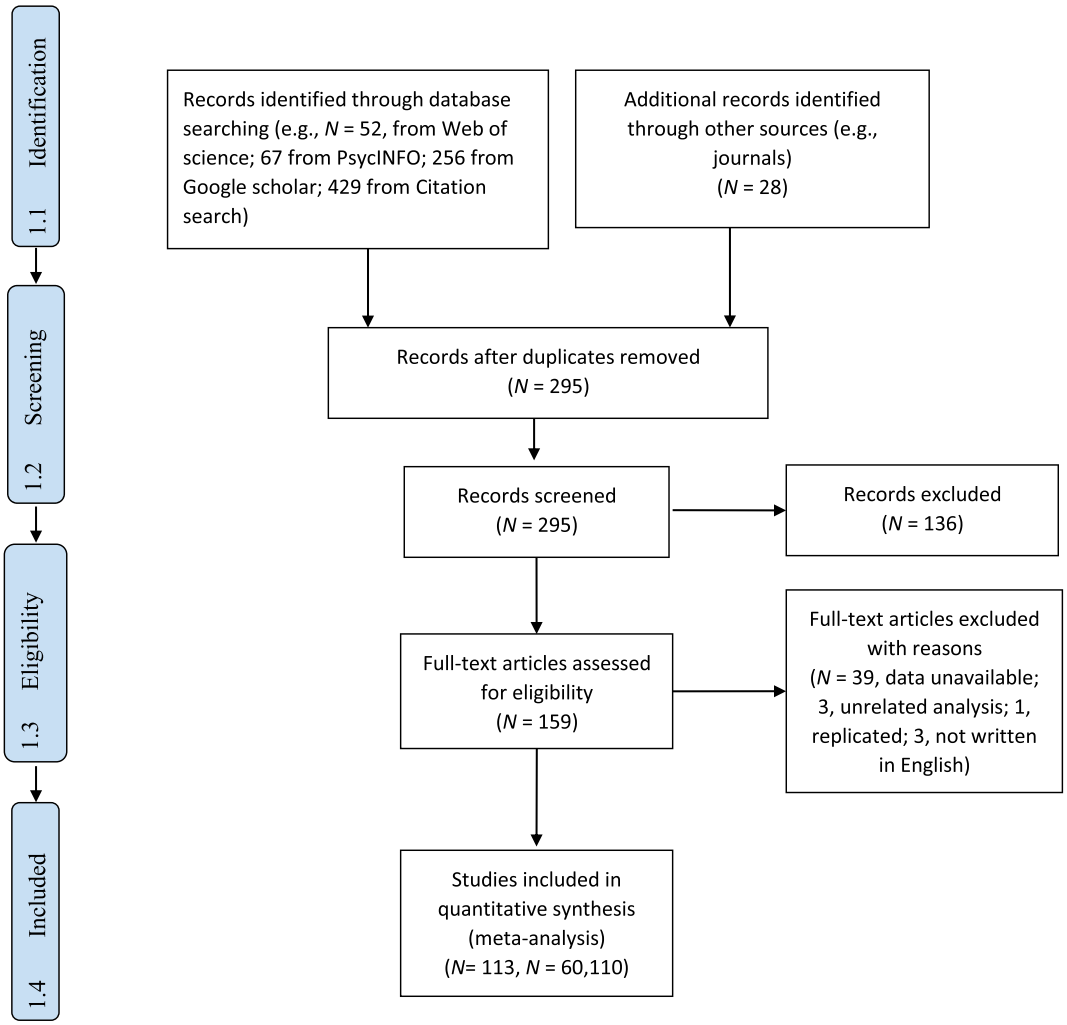


**Fig. 2.** Flow diagram of the search process.

## 3. Results

### 3.1. Cumulative effect sizes

#### 3.1.1. Antecedents and flow

Hypothesis 1 suggests positive relationships between challenge demands, job resources and flow, and a negative relationship between hindrance demands and flow. Meta-analytic results showed that challenge demands were not related to overall flow ($\rho = 0.03$; 95 % CI [−0.03; 0.10]). Job resources had a large[1] and positive relationship with flow ($\rho = 0.38$; 95 % CI [0.27; 0.47]). For example, job autonomy ($\rho = 0.40$; 95 % CI [0.33; 0.47]) and social support ($\rho = 0.28$; 95 % CI [0.22; 0.33]) were positively related to flow. Hindrance demands were also unrelated to flow ($\rho = 0.02$; 95 % CI [−0.16; 0.20]). These results reject Hypothesis 1a, support Hypothesis 1b, and reject Hypothesis 1c.

Hypothesis 2 refers to the associations between individual characteristics, including Big-Five personality, personal resources and demographics with flow. Results showed that openness ($\rho = 0.16$; 95 % CI [−0.19; 0.48]) and neuroticism ($\rho = -0.15$; 95 % CI [−0.36; 0.08]) were not related to flow. Conscientiousness ($\rho = 0.38$; 95 % CI [0.21; 0.53]), extraversion ($\rho = 0.33$; 95 % CI [0.18; 0.47]), and agreeableness ($\rho = 0.23$; 95 % CI [0.04; 0.40]) were each positively associated with flow with moderate effects. The cumulative relationships between personal resources and flow were large and significant ($\rho = 0.40$; 95 % CI [0.28; 0.51]). About demographics, results showed that age was weakly positively related to flow ($\rho = 0.10$; 95 % CI [0.02; 0.19]), but there were no significant

[1] We differentiated the size effect based on Cohen's (1988) rules of thumb for effect size evaluation ($r \geq 0.1$ small, $r \geq 0.3$ medium, and $r \geq 0.5$ large).

associations between flow and gender ($\rho = 0.001$; 95 % CI [−0.05; 0.05]), education ($\rho = -0.03$; 95 % CI [−0.11; 0.05]), and job tenure ($\rho = 0.05$; 95 % CI [−0.11; 0.20]). These results reject Hypothesis 2a and 2e, support Hypotheses 2b, 2c, 2d, 2f, and 2g.

Hypothesis 3 states that proactive behaviors will be positively related to flow. The overall cumulative effect of proactive behaviors was indeed large and significant ($\rho = 0.55$; 95 % CI [0.24; 0.77]). This result suggests that proactive behaviors are accompanied by a higher probability of experiencing flow. These results support Hypothesis 3.

Hypothesis 4 states that several positive leadership styles are positively related to flow. The results showed that the overall effect of leadership (i.e., authentic leadership, transformational leadership) on flow was positive and of moderate magnitude ($\rho = 0.44$; 95 % CI [0.36; 0.51]). These results support Hypothesis 4.

### 3.1.2. Flow and outcomes

Hypothesis 5 states that flow is related to well-being and several job-related outcomes (i.e., OCB, performance). The overall cumulative effects of flow on work engagement ($\rho = 0.73$; 95 % CI [0.59; 0.83]) and job satisfaction ($\rho = 0.67$; 95 % CI [0.55; 0.76]) were significant and large. Flow was moderately significantly associated with job commitment ($\rho = 0.44$; 95 % CI [0.26; 0.59]). At the same time, we found that flow was positively related to job performance ($\rho = 0.44$; 95 % CI [0.36; 0.51]), and creativity ($\rho = 0.35$; 95 % CI [0.21; 0.49]) with a moderate size, but had a large but nonsignificant association with organizational citizenship behavior ($\rho = 0.58$; 95 % CI [−0.08; 0.98]). These results support Hypothesis 5a-5e, but reject H5f.

Regarding Hypothesis 6, results showed that the link between flow and positive well-being is significant and large ($\rho = 0.52$; 95 % CI [0.41; 0.62]). Flow sub-dimensions were positively related to life satisfaction (e.g., flow absorption, $\rho = 0.22$; 95 % CI [0.41; 0.62]). Flow had a large and significant association with positive affect ($\rho = 0.50$; 95 % CI [0.25; 0.69]). However, the association between flow and negative well-being was not significant ($\rho = 0.00$; 95 % CI [−0.25; 0.26]). Flow was positively related to risk-taking behavior with a moderate size ($\rho = 0.31$; 95 % CI [0.05; 0.52]). However, flow was not related to burnout ($\rho = -0.01$; 95 % CI [−0.34; 0.33]) and negative affect ($\rho = 0.03$; 95 % CI [−0.23; 0.28]). These results support Hypothesis 6a, 6b, 6c, and 6d, but reject H6e and 6f.

## 3.2. Sub-dimensions of flow with its associates

As some of the results involving job demands were unexpected, we also looked into the sub-dimensions of flow with job demands. Results revealed that challenge demands were positively related with flow absorption with a moderate effect size ($\rho = 0.33$; 95 % CI [0.13; 0.50]), positively related with intrinsic motivation ($\rho = 0.11$; 95 % CI [0.06; 0.17]), but were not significantly related to enjoyment ($\rho = 0.14$; 95 % CI [−0.13; 0.39]). Hindrance demands were not significantly related to any of the flow sub-dimensions (e.g., absorption, $\rho = 0.10$; 95 % CI [−0.19; 0.38]). We also looked at the associations between leadership and flow sub-dimensions. Result showed that leadership was moderately positively related to flow absorption ($\rho = 0.38$; 95 % CI [0.34; 0.42]) and flow enjoyment ($\rho = 0.42$; 95 % CI [0.39; 0.46]). For a more fine-grained understanding, we also investigated how sub-dimensions of flow

**Table 2**
Meta-analysis results for the associations between antecedents and overall flow.

| Variable | $k$ | $N$ | $\bar{r}$ | $\rho$ | $SE\rho$ | Q | $CI_L$ | $CI_U$ | tau^2 | $I^2$ | $H^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Demographics | | | | | | | | | | | |
| Age | 12 | 2751 | 0.10 | 0.10 | 0.04 | 50.84*** | 0.02 | 0.19 | 0.02 | 77.48 % | 4.44 |
| Tenure | 5 | 1322 | 0.05 | 0.05 | 0.08 | 31.27*** | −0.11 | 0.20 | 0.03 | 84.93 % | 6.63 |
| Education | 7 | 1559 | −0.03 | −0.03 | 0.04 | 13.04* | −0.11 | 0.05 | 0.01 | 55.37 % | 2.24 |
| Gender (1 = male, 2 = female) | 9 | 1929 | 0.001 | 0.001 | 0.02 | 7.54 | −0.05 | 0.05 | 0.00 | 0.00 % | 1.00 |
| Challenge demands | 8 | 3035 | 0.03 | 0.03 | 0.03 | 10.83 | −0.03 | 0.10 | 0.00 | 35.56 % | 1.55 |
| Hindrance demands | 7 | 2335 | 0.02 | 0.02 | 0.09 | 62.45*** | −0.16 | 0.20 | 0.05 | 91.81 % | 12.21 |
| Job resources | 14 | 5656 | 0.32 | 0.38 | 0.06 | 104.74*** | 0.27 | 0.47 | 0.04 | 91.47 % | 11.73 |
| Autonomy | 13 | 5290 | 0.33 | 0.40 | 0.04 | 60.13*** | 0.33 | 0.47 | 0.02 | 82.04 % | 5.57 |
| Social support | 10 | 3472 | 0.25 | 0.28 | 0.03 | 19.82* | 0.22 | 0.33 | 0.00 | 51.16 % | 2.05 |
| Personal resources | 16 | 4713 | 0.35 | 0.40 | 0.07 | 389.63*** | 0.28 | 0.51 | 0.07 | 93.57 % | 15.56 |
| Self–efficacy | 3 | 955 | 0.33 | 0.37 | 0.08 | 7.32* | 0.22 | 0.49 | 0.01 | 76.23 % | 4.21 |
| Emotional intelligence | 3 | 635 | 0.40 | 0.41 | 0.04 | 0.14 | 0.34 | 0.48 | 0.00 | 0.00 % | 1.00 |
| Proactive behaviors | 4 | 876 | 0.49 | 0.55 | 0.20 | 72.28*** | 0.24 | 0.77 | 0.15 | 95.68 % | 23.17 |
| Personality | | | | | | | | | | | |
| Agreeableness | 3 | 617 | 0.19 | 0.23 | 0.10 | 7.08* | 0.04 | 0.40 | 0.02 | 70.89 % | 3.44 |
| Consciousness | 5 | 1620 | 0.29 | 0.38 | 0.10 | 26.97*** | 0.21 | 0.53 | 0.04 | 84.21 % | 6.33 |
| Extraversion | 4 | 1507 | 0.27 | 0.33 | 0.08 | 13.72** | 0.18 | 0.47 | 0.02 | 79.05 % | 4.77 |
| Neuroticism | 4 | 1507 | −0.11 | −0.15 | 0.12 | 27.62*** | −0.36 | 0.08 | 0.05 | 89.32 % | 9.36 |
| Openness | 3 | 617 | 0.13 | 0.16 | 0.18 | 24.170*** | −0.19 | 0.48 | 0.09 | 90.92 % | 11.01 |
| Leadership | 6 | 2134 | 0.41 | 0.44 | 0.05 | 16.81*** | 0.36 | 0.51 | 0.01 | 69.24 % | 3.25 |

*Note.* $N$ = total number of respondents; $k$ = number of independent samples included; $\bar{r}$ = sample-size-weighted mean correlation; $\rho$ = mean score correlation (corrected for unreliability for both variables and sampling error variance); $SE\rho$ = standard error for population estimate; $I^2$ is an index of heterogeneity computed as the percentage of variability in effects sizes that are due to true differences among the studies; Q provides information on whether there is statistically significant heterogeneity (i.e., yes or no heterogeneity); CI = 95 % confidential interval.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

**Table 3**
Meta-analysis results for overall flow and outcomes.

| Variable | $k$ | $N$ | $\bar{r}$ | $\rho$ | $SE\rho$ | Q | $CI_L$ | $CI_U$ | tau^2 | $I^2$ | $H^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Job attitudes | 13 | 6940 | 0.56 | 0.63 | 0.09 | 388.04*** | 0.51 | 0.73 | 0.11 | 97.36 % | 37.81 |
| Job commitment | 6 | 3308 | 0.37 | 0.44 | 0.11 | 47.60*** | 0.26 | 0.59 | 0.06 | 94.99 % | 19.94 |
| Work engagement | 5 | 2041 | 0.67 | 0.73 | 0.13 | 89.00*** | 0.59 | 0.83 | 0.08 | 95.44 % | 21.93 |
| Job satisfaction | 5 | 2528 | 0.60 | 0.67 | 0.10 | 63.88*** | 0.55 | 0.76 | 0.04 | 93.71 % | 15.91 |
| Overall performance | 14 | 5218 | 0.45 | 0.50 | 0.13 | 717.16*** | 0.28 | 0.67 | 0.25 | 98.53 % | 68.12 |
| OCB | 3 | 992 | 0.73 | 0.79 | 0.58 | 71.12*** | −0.08 | 0.98 | 1.00 | 99.59 % | 245.48 |
| Job performance | 7 | 2320 | 0.39 | 0.44 | 0.05 | 24.36*** | 0.36 | 0.51 | 0.01 | 74.25 % | 3.88 |
| Creativity | 5 | 2026 | 0.29 | 0.35 | 0.07 | 31.15*** | 0.21 | 0.49 | 0.02 | 82.55 % | 5.73 |
| Positive well-being | 11 | 3210 | 0.39 | 0.44 | 0.08 | 157.12*** | 0.31 | 0.56 | 0.06 | 92.65 % | 13.60 |
| Well-being | 7 | 2048 | 0.32 | 0.38 | 0.06 | 29.64*** | 0.28 | 0.47 | 0.02 | 77.19 % | 4.38 |
| Positive affect | 4 | 1462 | 0.46 | 0.50 | 0.15 | 89.10*** | 0.25 | 0.69 | 0.11 | 96.04 % | 25.28 |
| Negative well-being | 9 | 8577 | −0.04 | −0.04 | 0.14 | 719.74*** | −0.30 | 0.23 | 0.12 | 98.9 % | 75.03 |
| Burnout | 7 | 7901 | −0.01 | −0.01 | 0.18 | 639.28*** | −0.34 | 0.33 | 0.22 | 99.04 % | 103.83 |
| Negative affect | 4 | 1187 | 0.03 | 0.03 | 0.13 | 49.34*** | −0.23 | 0.28 | 0.06 | 92.60 % | 13.52 |
| Risk-taking behavior | 5 | 469 | 0.25 | 0.31 | 0.13 | 25.15*** | 0.05 | 0.52 | 0.07 | 79.70 % | 4.93 |

*Note*. OCB = organizational citizenship behavior.
*** $p < .001$.

related to the overall outcome category. The cumulative effects of flow sub-dimensions on job satisfaction were positive and large ($\rho$ = 0.57–0.59). All the sub-dimensions of flow were significantly related to job performance with a moderate size (e.g., absorption, $\rho$ = 0.27; 95 % CI [0.12; 0.41]). A closer examination revealed that each of the sub-dimensions of flow had a large and significant effect on job satisfaction ($\rho$ = 0.62–0.63). Work enjoyment was predictive of life satisfaction compared to two other dimensions ($\rho$ = 0.44; 95 % CI [0.30; 0.55]) (Tables 2 to 5).

### 3.3. Moderation analysis on culture and measures

We tested the inter-correlations between flow sub-dimensions and conducted moderation analysis on flow measures. Type of flow measurement did not moderate the relationship between job resources and flow (Moderator = 0.19, $p$ = .67), job performance (Moderator = 0.73, $p$ = .39), well-being (Moderator = 0.02, $p$ = .88), and job attitudes (Moderator = 1.34, $p$ = .25). These results suggest that the associations with flow that we found, were not dependent on the type of flow measurement.

In addition, we tested whether culture (western vs. eastern) moderated the relationship between flow and its associates. Results showed that culture did not moderate between flow and job resources (Moderator = 0.01, $p$ = .91), personal resources (Moderator = 2.28, $p$ = .38), leadership (Moderator = 0.02, $p$ = .13), job performance (Moderator = 1.05, $p$ = .30). These results indicate the relationship between flow and its associates hold across culture.

### 3.4. Relative weight and pairwise subgroup analysis

We further conducted Relative Weights Analysis (RWA) to compare the effects of flow sub-dimensions on main flow outcomes. RWA is a method of calculating relative importance of predictor variables in contributing to an outcome variable (Johnson & LeBreton, 2004). RWA can provide estimates of the relative contribution of predictor variables when the predictor variables are correlated. Because there were high intercorrelations between the sub-dimensions of flow ($\rho$ = 0.66–0.80), it is appropriate to conduct RWA to provide a more fine-grained understanding on the effects of sub-dimensions of flow. Results in Table 6 showed that the most explained variance in job performance can be attributed to enjoyment (52 % of model $R^2$), followed by absorption (27 % of model $R^2$), and then intrinsic motivation (21 % of model $R^2$). Regarding life satisfaction, most variance was explained by intrinsic motivation (66 % of model $R^2$), enjoyment (22 % of model $R^2$), and absorption (12 % of model $R^2$). Job satisfaction was explained by enjoyment (45 % of model $R^2$), absorption (40 % of model R2), and intrinsic motivation (15 % of model $R^2$) (Tables 7 and 8).

In line with Yao et al. (2022), we conducted pairwise subgroup analyses to compare the relative strength of the associations between flow and its antecedents and consequences. Pairwise subgroup analyses enabled us to see which antecedent was more strongly related to flow by comparing the size effects (Yao et al., 2022). Results showed that hindrance demands had weaker relationships with flow than job resources ($t$ = 11.69, $p$ < .001), personal resources ($t$ = 12.04, $p$ < .001), proactive behaviors ($t$ = 6.94, $p$ < .01), and leadership ($t$ = 18.96, $p$ < .001). Leadership had a stronger correlation with flow than job resources ($t$ = 3.98, $p$ = .046). No other significant differences were found ($p$ > .37). In addition, we used subgroup analysis to compare the differences in the associations between flow and outcomes. We found that flow had significantly weaker relationships with negative well-being than other outcomes, including job attitudes ($t$ = 16.66, $p$ < .001), job performance ($t$ = 9.91, $p$ < .01) and positive well-being ($t$ = 17.02, $p$ < .001) (see Supplements Table A5 for more details).[2]

[2] Note that in the relative weight analyses and subgroup analyses, only a limited selection of studies on a certain variable ($k \geq 3$) was included and examined to ensure statistical power (Valentine et al., 2010).

**Table 4**
A summary of results on sub-dimensions of flow.[a]

| | Flow absorption | | Flow enjoyment | | Flow intrinsic motivation | |
|---|---|---|---|---|---|---|
| | $\rho$ (*SE*) | 95 % *CI* | $\rho$ (*SE*) | 95 % *CI* | $\rho$ (*SE*) | 95 % *CI* |
| Antecedents of flow | | | | | | |
| Challenge demands | **0.33** (0.11) | [0.13, 0.50] | 0.14 (0.14) | [−0.13, 0.39] | 0.11 (0.03) | [0.06, 0.17] |
| Hindrance demands | 0.10 (0.15) | [−0.19, 0.38] | −0.01 (0.15) | [−0.29, 0.28] | 0.03 (0.23) | [−0.40, 0.44] |
| Social support | 0.15 (0.06) | [0.04, 0.26] | **0.36** (0.05) | [0.27, 0.43] | 0.31 (0.06) | [0.19, 0.42] |
| Autonomy | 0.33 (0.05) | [0.25, 0.41] | 0.37 (0.06) | [0.26, 0.48] | **0.41** (0.05) | [0.34, 0.48] |
| Self-efficacy | – | [0.25, 0.53] | **0.44** (0.09) | [0.29, 0.57] | 0.40 (0.08) | [0.25, 0.53] |
| Optimism | – | [0.24, 0.50] | **0.42** (0.06) | [0.33, 0.51] | 0.38 (0.08) | [0.24, 0.50] |
| Leadership | 0.38 (0.02) | [0.39, 0.46] | **0.42** (0.02) | [0.39, 0.46] | – | |
| Outcomes of flow | | | | | | |
| Work engagement | 0.79 (0.31) | [0.44, 0.93] | – | | – | |
| Job satisfaction | 0.62 (0.25) | [0.24, 0.84] | **0.63** (0.18) | [0.36, 0.80] | **0.63** (0.20) | [0.33, 0.82] |
| Job performance | 0.27 (0.08) | [0.12. 0.41] | **0.33** (0.10) | [0.14, 0.50] | 0.26 (0.04) | [0.18, 0.33] |
| OCB | 0.44 (0.18) | [0.12, 0.67] | – | | – | |
| Life satisfaction | 0.22 (0.04) | [0.15, 0.29] | **0.44** (0.08) | [0.30, 0.55] | 0.35 (0.04) | [0.29, 0.41] |
| Negative affect | 0.11 (0.10) | [−0.29, 0.08] | – | | – | |

[a] The bold number indicates the flow sub-dimension(s) that has the strongest associations with antecedents/outcomes.

**Table 5**
Relative weight analysis of the flow dimensions and job performance life satisfaction, and job satisfaction.[a]

| Variables | Job performance | | Life satisfaction | | Job satisfaction | |
|---|---|---|---|---|---|---|
| | Raw.RW | Rescaled.RW | Raw.RW | Rescaled.RW | Raw.RW | Rescaled.RW |
| Absorption | 0.03 | 27.11 | 0.06 | 12.05 | 0.26 | 40.42 |
| Enjoyment | 0.06 | **52.05** | 0.11 | 22.21 | 0.28 | **44.63** |
| Intrinsic motivation | 0.02 | 20.84 | 0.33 | **65.73** | 0.09 | 14.95 |
| R-square | 0.12 | | 0.50 | | 0.63 | |

*Note*. The meta-analytic input matric is presented in Supplements Table A7. RW = relative weight.
[a] The bold number represents the flow sub-dimension that contributes most to explaining the variances of the dependent variables.

**Table 6**
A summary of stated hypotheses and corresponding results.

| Variable | Hypothesis number | Stated direction | Summary of statistics | | | | | Hypothesis confirmed? |
|---|---|---|---|---|---|---|---|---|
| | | | $\rho$ | $SE\rho$ | *k* | CIL | CIU | |
| Challenge demands | H1a | Positive | 0.03 | 0.03 | 8 | −0.03 | 0.10 | No |
| Job resources | H1b | Positive | 0.38 | 0.06 | 14 | 0.27 | 0.47 | Yes |
| Hindrance demands | H1c | Negative | 0.02 | 0.09 | 7 | −0.16 | 0.20 | No |
| Openness | H2a | Positive | 0.16 | 0.18 | 3 | −0.19 | 0.48 | No |
| Conscientiousness | H2b | Positive | 0.38 | 0.10 | 5 | 0.21 | 0.53 | Yes |
| Extraversion | H2c | Positive | 0.33 | 0.08 | 4 | 0.18 | 0.47 | Yes |
| Agreeableness | H2d | Positive | 0.23 | 0.10 | 3 | 0.04 | 0.40 | Yes |
| Neuroticism | H2e | Negative | −0.15 | 0.12 | 4 | −0.36 | 0.08 | No |
| Personal resources | H2f | Positive | 0.40 | 0.07 | 16 | 0.28 | 0.51 | Yes |
| Demographics | H2g | Neutral | – | – | – | – | – | Yes |
| Proactive behaviors | H3 | Positive | 0.55 | 0.20 | 4 | 0.24 | 0.77 | Yes |
| Leadership | H4 | Positive | 0.44 | 0.05 | 6 | 0.36 | 0.51 | Yes |
| Work engagement | H5a | Positive | 0.73 | 0.11 | 5 | 0.59 | 0.83 | Yes |
| Job satisfaction | H5b | Positive | 0.67 | 0.10 | 5 | 0.55 | 0.76 | Yes |
| Job commitment | H5c | Positive | 0.44 | 0.11 | 6 | 0.26 | 0.59 | Yes |
| Job performance | H5d | Positive | 0.44 | 0.05 | 7 | 0.36 | 0.51 | Yes |
| Creativity | H5e | Positive | 0.35 | 0.07 | 5 | 0.21 | 0.49 | Yes |
| OCB | H5f | Positive | 0.79 | 0.58 | 3 | −0.08 | 0.98 | No |
| Well-being | H6a | Positive | 0.38 | 0.06 | 7 | 0.28 | 0.47 | Yes |
| Life satisfaction | H6b | Positive | 0.22 | 0.04 | 3 | 0.15 | 0.29 | Yes |
| Positive affect | H6c | Positive | 0.50 | 0.15 | 4 | 0.25 | 0.69 | Yes |
| Risk-taking | H6d | Positive | 0.31 | 0.13 | 5 | 0.05 | 0.52 | Yes |
| Negative affect | H6e | Negative | 0.03 | 0.13 | 4 | −0.23 | 0.28 | No |
| Burnout | H6f | Negative | −0.01 | 0.18 | 7 | −0.34 | 0.33 | No |
| Culture | H7a | – | | | | | | No |
| Flow measures | H7b | – | | | | | | No |

**Table 7**
Meta-analysis results for moderation analysis: the role of measures of flow.

| Variables | Measuremnent | *k* | ZCOR | *SE* | $CI_L$ | $CI_U$ | *p* | Q | $I^2$ | $I^2_L$ | $I^2_U$ | Moderator | *p* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Job attitudes | Others | 6 | 0.61 | 0.14 | 0.33 | 0.80 | 0.00 | 140.50 | 0.96 | 0.94 | 0.98 | 0.07 | 0.78 |
| | WOLF | 7 | 0.66 | 0.12 | 0.43 | 0.88 | 0.00 | 317.04 | 0.98 | 0.97 | 0.99 | | |
| Job performance | Others | 5 | 0.38 | 0.06 | 0.26 | 0.49 | 0.00 | 18.16 | 0.78 | 0.47 | 0.91 | 0.73 | 0.39 |
| | WOLF | 10 | 0.52 | 0.16 | 0.21 | 0.84 | 0.00 | 683.38 | 0.99 | 0.98 | 0.99 | | |
| Positive well-being | Others | 6 | 0.44 | 0.11 | 0.22 | 0.65 | 0.00 | 109.89 | 0.95 | 0.92 | 0.97 | 0.16 | 0.69 |
| | WOLF | 5 | 0.38 | 0.10 | 0.17 | 0.58 | 0.00 | 61.64 | 0.94 | 0.88 | 0.97 | | |
| Job resources | Others | 3 | 0.29 | 0.07 | 0.16 | 0.42 | 0.00 | 16.94 | 0.88 | 0.67 | 0.96 | 0.19 | 0.67 |
| | WOLF | 19 | 0.32 | 0.04 | 0.25 | 0.40 | 0.00 | 96.80 | 0.81 | 0.72 | 0.88 | | |

*Note*. ZCOR = Z correlation score; WOLF = work-related flow scale.

**Table 8**
Meta-analysis results for moderation analysis: the role of culture.

| Variables | Subgroup | *k* | ZCOR | *SE* | $CI_L$ | $CI_U$ | *p* | Q | $I^2$ | $I^2_L$ | $I^2_U$ | Moderator | *p* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | Eastern | 4 | 0.11 | 0.12 | −0.12 | 0.34 | 0.34 | 42.54 | 0.93 | 0.85 | 0.97 | 0.01 | 0.91 |
| | Western | 8 | 0.10 | 0.03 | 0.04 | 0.16 | 0.00 | 7.65 | 0.08 | 0.00 | 0.70 | | |
| Job resources | Eastern | 2 | 0.52 | 0.20 | 0.12 | 0.91 | 0.01 | 20.94 | 0.95 | 0.86 | 0.98 | 0.78 | 0.38 |
| | Western | 10 | 0.33 | 0.05 | 0.23 | 0.43 | 0.00 | 57.30 | 0.84 | 0.73 | 0.91 | | |
| Personal resources | Eastern | 5 | 0.52 | 0.13 | 0.27 | 0.78 | 0.00 | 131.79 | 0.97 | 0.95 | 0.98 | 0.28 | 0.13 |
| | Western | 9 | 0.30 | 0.06 | 0.18 | 0.43 | 0.00 | 116.68 | 0.93 | 0.89 | 0.96 | | |
| Leadership | Eastern | 3 | 0.42 | 0.08 | 0.27 | 0.58 | 0.00 | 8.43 | 0.76 | 0.22 | 0.93 | 0.02 | 0.88 |
| | Western | 3 | 0.44 | 0.07 | 0.30 | 0.58 | 0.00 | 11.67 | 0.83 | 0.48 | 0.94 | | |
| Job performance | Eastern | 8 | 0.58 | 0.20 | 0.19 | 0.97 | 0.00 | 629.80 | 0.99 | 0.99 | 0.99 | 1.05 | 0.30 |
| | Western | 5 | 0.36 | 0.06 | 0.24 | 0.48 | 0.00 | 20.54 | 0.81 | 0.54 | 0.92 | | |
| Positive well-being | Eastern | 2 | 0.42 | 0.17 | 0.21 | 0.63 | 0.00 | 8.98 | 0.89 | 0.58 | 0.97 | 0.53 | 0.77 |
| | Western | 5 | 0.35 | 0.09 | 0.17 | 0.53 | 0.00 | 70.96 | 0.94 | 0.90 | 0.97 | | |

*Note*. We only conducted subgroup analyses when $k \geq 3$.

## 4. Discussion

The current study aimed to identify the key antecedents and outcomes relevant to work-related flow, and (a) provide a nomological network and (b) spot areas for future research on flow by synthesizing different perspectives and theories related to flow (e.g., job characteristics, individual behaviors, leadership). This can advance the theoretical and empirical development of flow and pave the way for future flow research. To this end, we conducted a meta-analysis to establish the essential antecedents, outcomes, and methodological moderators of flow, and also compared their size effects. Results showed that, in general, proactive behavior was strongly related to flow with the highest size effect ($\rho = 0.55$). Other antecedents, including challenge demands, job resources, personal resources, personality, and leadership, were also positively related to flow. Hindrance demands were shown to be unrelated to flow. In addition, we assessed various flow outcomes, including job-related and personal outcomes. Results showed that flow was mainly associated with positive well-being, such as a higher level of job (and life) satisfaction and positive affect, but, in general, was not significantly related to negative well-being, including negative affect and burnout, although flow was accompanied by a higher level of risk-taking behavior. We discuss the theoretical and practical implications, and provide future research directions below.

### *4.1. Theoretical implications*

First, the present study contributes to the theoretical underpinnings of flow by drawing on various theories and literatures related to flow, including JCT (Hackman & Oldham, 1976), JD-R (Bakker et al., 2023), the self-determination model of flow (Bakker & Van Woerkom, 2017), proactivity theory (Grant & Ashford, 2008; Parker et al., 2019), and personality and leadership literatures (Dunkel et al., 2022; Linsner, 2009). This adds to the flow literature because previous studies mainly focused on specific aspects related to flow, such as skill-challenge balance, proactive antecedents of flow, etc. Few studies have tried to connect these different associates and provide an overarching understanding of flow. Our study advances flow literature by establishing the relationships between different associates and flow (subdimensions). This first nomological network of flow provides a more complete and comprehensive theory- and evidence-based foundation for work-related flow research.

Second, regarding the antecedents of flow, drawing on extant findings, we introduced four relatively broad categories distinguishing the different types of antecedents of flow, including job characteristics, individual characteristics, individual behaviors, and leadership characteristics. This approach has the merits of (a) enabling us to examine and further compare the effects of different antecedents of flow within and between each category (b) providing a clear roadmap for future research in terms of what variable should be further investigated within each category. Specifically, we confirmed several hypothesized associations between antecedents and flow, including job resources, personality (conscientiousness, extraversion, and agreeableness), personal resources, proactive behavior, and leadership characteristics. These results were in line with JD-R theory (Bakker et al., 2023), proactivity theory (Bakker &

Van Woerkom, 2017; Parker et al., 2019), and personality and leadership literatures (Linsner, 2009; Ullén et al., 2012; Zubair & Kamal, 2015). This extends the literature because it helps summarize and structure the flow antecedents and provides potential directions for flow research in the future.

Note that several hypotheses about antecedents were not supported. We did not find a positive association between challenge demands and flow. However, we revealed positive associations between challenge demands and sub-dimensions of flow (i.e., absorption and intrinsic motivation). These findings fit with the notion that difficult but durable tasks tend to yield flow because they require full attention but also bring a sense of competence (Ryan & Deci, 2000). Nevertheless, we also found that higher challenges do not necessarily increase enjoyment (happiness). This is because working on difficult tasks can give a sense of fulfillment, once they are accomplished, but may not be particularly joyful while working on them. Also, we did not find a negative association between hindrance demands and flow. Van Oortmerssen et al. (2020) previously reported a negative effect of hindrance demands on flow. The reasons for the non-significant relationships in the present study, however, are not clear. The effects of hindrance demands on flow may depend on how individuals perceive various demands (Li et al., 2021). Regarding personality, openness and neuroticism were not related to flow. One possible explanation for this is that openness tends to be the least social dimension of the Big Five inventory. For example, it is generally found to have the weakest links with social effectiveness. Neurotic individuals have unstable emotions (Gosling et al., 2003) which may undermine flow, or prevent individuals to be proactive. Although in this case, it does not seem to interfere with flow either.

Third, by conducting relative weight and subgroup analyses, we compared the size effects regarding the strength of association between different categories of flow. Specifically, we found that proactive behaviors displayed the strongest association with flow. Apart from job characteristics, the self-determination model of flow suggests a connection between proactivity and flow (Bakker & Van Woerkom, 2017; Liu et al., 2021). Our findings suggest that individuals can potentially facilitate flow in a more proactive manner compared to other antecedents. Overall, the current findings complement the literature on antecedent of flow by suggesting which aspects of their job they can change and the concrete behavioral strategies people can use to facilitate flow.

Lastly, we complement the literature on flow outcomes by showing that flow was associated with several job-related outcomes (e.g., job performance, job satisfaction, commitment) and personal outcomes, including positive affect and life satisfaction. These results suggest that flow improves the quality of life (Csikszentmihalyi, 2020) and can be carried over from work-domain to family-domain (Demerouti et al., 2012). This adds to spillover-crossover theory (Bakker & Demerouti, 2013) because work-related flow is an intensely affective and cognitive experience which can be extended to family domain, we empirically tested this. We did not find a significant relationship between flow and negative well-being. This might be because the consequences of flow depend on the duration of flow (e.g., time), the extent to which people detach from flow, and the ability to focus after flow (De Sampaio Barros et al., 2018). For example, flow is energizing but consumes considerable cognitive resources. Consequently, whether flow leads to fatigue may be influenced by the time that individuals spend on tasks. Flow indicates deep immersion into the task at hand. The performance after flow on the subsequent tasks may depend on whether individuals can quickly transfer their attention from task to task. Otherwise, individuals may perform worse on the following task because they ruminate on the tasks in which they experience flow (Liu et al., 2021; Newton et al., 2020).

### *4.2. Practical implications*

From a top-down perspective, our findings reflect that positive leadership styles, including transformational and authentic leadership, as well as leadership member exchange may relate to flow. If employees can be inspired by their leaders and their values and beliefs, they may more likely achieve optimal functioning at work. On the other side, leaders are encouraged to use positive leadership styles such as authentic leadership and transformational leadership, allowing subordinates to acquire more autonomy and trust in their leaders. For example, leaders can learn to be authentic and act in accord with their core values, which may have cross-over effects on followers and increase the trust and confidence of employees (Avolio & Gardner, 2005). To achieve so, leaders should disclose themselves more often, such as sharing the missions and social impacts of their company. This also suggests that organizations can help managers to develop more effective and positive leadership styles rather than simply change the work environment. Although this may be difficult as a leadership style is also colored by personality and the climate of the organization, leadership style can be learned and developed (Avolio & Gardner, 2005). On this notion, practitioners and scholars researching on leadership are encouraged to converse with organizations to establish tailored leadership styles for each organization.

At the same time, organizations may want to help employees understand their strong points (i.e., character strengths) and provide opportunities to apply their strengths to their work. This has been consistently shown to be an effective strategy to foster optimal functioning (Bakker et al., 2019; Liu et al., 2021). Employers should provide job resources (i.e., autonomy, social support) to their employees from an organizational perspective. For example, employers can provide more support for their employees, such as workshops and trainings, to help employees use more playful work design strategy. It is noteworthy despite that job resources may improve the skill-challenge balance, which is an essential antecedent of flow, whether resources profit or undermine flow may depend on the initial perceived task challenges (Ceja & Navarro, 2012). Specifically, if the challenge would be relatively low whereas resources are abundant, this may hamper the flow experience.

From a bottom-up perspective, more interestingly, the comparison of the different associations of flow can also provide insights into what employees should do to facilitate flow. As we found that proactive behaviors seem to be strongly related to flow (in terms of size effect) followed by leadership, personal resources, and then job resources. This suggests that it is vital for employees to identify the proactive behaviors effective for themselves. For example, employees can choose to use proactive behaviors, including playful work design (Bakker & Van Woerkom, 2017), strengths use (Liu et al., 2021), proactive vitality management (Op den Kamp et al., 2018), and

job crafting (Bakker & Van Woerkom, 2017) by themselves to increase the likelihood of flow. Proactive behavior helps individuals achieve goals and better satisfy their basic psychological needs because they take anticipatory actions (Bakker & Van Woerkom, 2017).

### 4.3. Strengths, limitations, and future research direction

One of the main strengths and contributions of the current study is that we used several broad categories to distinguish the antecedents and outcomes of flow via synthesizing different perspectives. This enabled us to identify underdeveloped areas in the flow literature and to provide a clear direction for future research. First, within the job characteristics category, many studies have focused on general and stable characteristics including job demands and resources (Demerouti, 2006; Hackman & Oldham, 1976; Oerlemans & Bakker, 2018), However, as flow is a relatively short and transient experience, it is important that future research investigates whether daily or momentary fluctuations in task and social characteristics have an impact on work-related flow. For example, will the task that provides more social interaction leads to more flow? Will one's flow experiences be influenced by other's flow experience or overall flow at a team level? Will attribution of tasks such as attentional pull have an impact on flow experience? In line with these queries, Fullagar and Delle Fave (2017) also suggested that flow is a short-term experience and needs to be studied using the experience sampling method.

Second, in terms of individual characteristics, the current study did not involve flow proneness and flow disposition as the number of studies related to these variables was $< 3$. However, as they are important individual characteristics predicting flow, future researchers may also want to examine the association between flow proneness/disposition and flow experience to identify the extent to which flow personality can be translated into flow experience and in what situations. For example, will the work episodes with more rewarding cues (e.g., challenge) can help translate flow personality into flow experiences?

In addition, as the current study only examines limited types of proactive behavior, including job crafting and strengths use, etc. (Liu et al., 2021; Mihelič & Aleksić, 2017), other types of proactive behavior can also be potentially linked to flow but have not been investigated yet, including proactive vitality management (Op den Kamp et al., 2018), goal-setting nudge (Weintraub et al., 2021), voice, taking charge, and problem prevention (Parker et al., 2019). Future studies can investigate whether these proactive behaviors facilitate/impede flow. This will enrich literature by broadening the repertoire for employees to choose what proactive strategies they can use to improve their work state. Lastly, we encourage flow researchers to investigate flow in a multilevel process (Bakker, 2022). As flow is an intense experience which requires and also provides energy, it will be interesting to look into the within-person process of changes in flow experience, such as how episodic level recovery and energy may benefit flow, as well as the potential moderators at a team level, such as the diversity in a team.

The present study is not without limitations. First, the current study cannot address causal effects regarding antecedents and outcomes of flow. The majority of studies included in the current meta-analysis used cross-sectional design ($k = 76$, 67.3 %), experience sampling method ($k = 23$, 20.4 %), longitudinal study ($k = 12$, 10.6 %), and experimental design ($k = 2$, 1.8 %). Since calculating cumulative effects requires satisfying the criteria $k \geq 3$, the current results were primarily based on cross-sectional data. In the future, research can examine causal associations by employing experimental, interventional, and longitudinal designs.

Second, some of our findings were based on a relatively small size of samples (e.g., self-efficacy, $k = 3$; neuroticism, $k = 4$; openness, $k = 3$). This reminds the readers to be cautious when interpreting the findings (in particular when $k \leq 10$). However, it still provides the most accurate summary based on existing data by averaging the correlations and correcting them. Some researchers have also argued that the minimum number for conducting meta-analyses is two (Valentine et al., 2010). The other restriction that resulted from the small sample size is that we could not address the potential moderators in terms of job characteristics and personality (Peifer & Wolters, 2021). According to the self-determination model of flow (Bakker & Van Woerkom, 2017), flow proneness, openness, and playfulness may bolster the effects of proactive behaviors on flow. In addition, organizational factors such as job resources may strengthen the positive relationship between the antecedents and flow. However, we cannot obtain enough studies that have addressed such moderating effects (e.g., heterogeneity, $k \geq 3$). Therefore, we encourage future studies to investigate the boundary conditions that modulate the effects of flow on its associates, such as flow proneness and support for flow. Also, note that the confidential intervals of agreeableness and risk-taking behavior were rather wide, indicating that either the number of included studies ($k$) is small or their effect sizes in relation to flow might be moderated by specific conditions (e.g., propensity for risks). We encourage future research to examine potential moderating conditions regarding the link between these two variables and flow. As different studies may vary in the aspects of data source (single source vs. multiple source; student vs. employees), time of measurement (single-time vs. multi-time), and level of measurement (single level vs. multiple level), future studies are also encouraged to take these factors into account when conducting moderation analysis (Rudolph et al., 2020).

Third, flow might play a mediating role between its antecedents and outcomes. Unfortunately, there were not enough studies (consider flow as a mediator) that afforded us to conduct such analyses. Future studies should examine the potential mediating role of flow based on the availability of published articles. Moreover, future studies should investigate the underlying mechanism why proactive behaviors can facilitate flow experience. For example, is it because proactivity helps satisfy basic psychological needs? Or proactive behaviors help establish a better skill-challenge balance? Or proactive behaviors increase personal resources? These questions are worth investigating.

Finally, the current study did not provide predictions on the magnitude of the relationships between flow and its associates. The reason for this is that there was no theoretical or empirical basis that justified such predictions. For example, there is limited number of included studies (e.g., self-efficacy, openness), or the range of effect size is large (e.g., −0.02 to 0.62 for job resources). In line with other meta-analysis (Howard et al., 2020), we did not make predictions on size effects. However, we think it is interesting and important for future studies to make and test the predictions once more empirical evidence has been established.

## 5. Conclusion

Except for the well-recognized predictors of flow, such as job demands and resources, the current study suggests that individuals have the potential to create or facilitate flow experiences using proactive strategies. Several personality dimensions (e.g., agreeableness) and leadership (e.g., authentic leadership) are also positively associated with flow. Overall, we confirm that flow might be beneficial to work and personal well-being. We encourage individuals to reach flow in their proactive ways.

## CRediT authorship contribution statement

**Wei Liu**: Conceptualization, Methodology, Data-collection, Writing - Original Draft, Writing - Review & Editing, Visualization, Funding acquisition. **Hairong Lu**: Data-collection, Writing - Review & Editing. **Peikai Li**: Conceptualization, Methodology, Data-collection, Formal analysis, Writing - Review & Editing, Visualization. **Dimitri van der Linden**: Validation, Writing - Review & Editing, Supervision. **Arnold B. Bakker**: Validation, Conceptualization, Methodology, Writing - Review & Editing, Supervision.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

The included articles, raw data, and supplementary materials (e.g., search process) are deposited in a data repository and available at OSF (https://osf.io/z3cr4/). All the authors have given consent to the potential publication of this article. We ensure that the writing is free from bias, stereotypes, slang, reference to dominant culture and/or cultural assumptions following APA guidelines.

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## Appendix A. Supplementary materials

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jvb.2023.103891.

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