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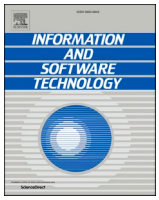

Burnout in agile teams: The role of mindful software development

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ABSTRACT

Context: Agile project management methods are widely adopted in software development, offering flexibility and efficiency. However, the dynamic and fast-paced nature of agile environments can subject team members—such as developers, business analysts, and project managers—to stress, potentially leading to work exhaustion and burnout.

Objectives: This study aims to investigate the role of mindfulness as a dynamic personality trait in reducing burnout in agile software development environments. It focuses on how mindfulness influences the use of problem-focused and emotion-focused coping strategies to mitigate burnout. We examine whether mindful agile practitioners are more likely to adopt problem-focused rather than emotion-focused coping strategies, and whether these strategies help alleviate burnout.

Methods: The research draws on the theoretical foundations of mindfulness and the transactional model of stress and coping (TMSC) to develop a model for understanding the relationships between mindfulness, coping behaviors, and burnout. The proposed model was tested through a survey of 319 IT and software development professionals who use agile methods in their work. Finally, path analysis was conducted using SmartPLS to assess the hypothesized relationships.

Results: The findings of this research suggest that individuals with higher levels of mindfulness in agile software development are more likely to adopt problem-focused coping behaviors, which in turn reduces burnout. In addition, the results show that mindful agile team members also use coping strategies to gain emotional stability (e.g., venting to their colleagues) although it may increase their level of burnout.

Conclusion: Contextualizing the notion of mindful engagement with agile software development methods (or agile mindfulness), this paper concludes that agile mindfulness, as a dynamic resource, can be helpful in identifying solutions to reduce the stress and burnout of team members via promoting problem-solving coping behaviours. From the practical perspective, this research helps organizations and agile teams with practical recommendations to leverage mindfulness, and introduces coping behaviors that help them manage and even prevent burnout in agile environments.

1. Introduction

Agile is now the most widely used methodology in the information systems development (ISD) industry [1]. According to global industry surveys, more than 90 % of software development activities use agile approaches in some form [2]. The predominant view is that agile methods are largely beneficial to software development projects by providing more effective mechanisms for capturing and responding to customers' changing requirements, increasing the quality of the product, and facilitating the creation of true business value in uncertain and volatile situations [3,4].

Despite all the benefits of agile methods to projects, teams, individuals, and developers may experience agile ISD practice as a burden at the same time [3,5]. The dynamic nature of agile methods requires frequent delivery of working software increments in short iterations, constant close collaboration with the customer on a daily basis, short feedback loops, and openness to changing requirements even late in the project [6,5]. Due to these demands, when implementing agile methods, teams may face difficulties such as role ambiguity, evolving responsibilities, insufficient training, and resistance to organisational

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change [1,7,5]. Also, agile teams may experience difficulties such as frequent context switching, sustained high work intensity due to continuous delivery cycles, and the pressure of constant responsiveness to changing requirements [8,7]. Moreover, the iterative nature of agile can blur boundaries between work and rest, especially when combined with unrealistic stakeholder expectations and inadequate support from leadership. All these can increase cognitive and emotional strain and put pressure and burdens on agile team members [3–5]. The potential consequence of these burdens can cause work exhaustion and fatigue for agile system development team members [4]. Evidence from the industry supports this concern and advocates that the "*constant strive for improvement, the relentless drive for feedback, [and] the subsequent changes in direction and the incessant social interactions*" in agile methods bring exhaustion and job strain at least for some individuals in agile development teams [9]. Developers have reported that in some occasions over the course of the project, agile practices can be "*depleting*" and make them "*utterly fatigued*" [3]. Recent academic research also suggests that work exhaustion and stress are present among individuals in agile teams [3–5]. Many reasons could explain burnout when using agile methods. For example, while the empowering aspects of agile ISD practices were shown to motivate developers, they could also result in ineffective decision-making, potentially causing stress and exhaustion [10,11,4]. Likewise, although enhanced communication and knowledge sharing within agile ISD teams help align work, they also demand strong self-discipline to overcome communication challenges which may drain developers' level of energy over the course of the project [12,13,4]. Given the ambivalent implications of agile ISD for developers, it is paramount to understand how the adverse effects of agile ISD are developed and how they can be mitigated to prevent exhaustion and burnout [4].

One avenue to explain exhaustion among agile team members is through studying developers' personal characteristics and how they cope with the challenges of agile software development [5]. There is an emphasized consensus in the literature that personal attributes are key factors in explaining how individuals cope (or fail to cope) with stress and work exhaustion [5]. Following this premise, only recently have IS scholars begun to look into the individual-level implications of agile ISD for developer stress and work exhaustion [3,4,14,5,15]. Despite these works, IS research still provides little insight into whether and how individual developers' characteristics and the way in which they engage with agile methods play a role in mitigating the pressure and exhaustion that people may experience in agile software development.

To narrow the above gap, we focus on *mindfulness* as an established concept with growing practical and theoretical applications in information systems for managing and mitigating stress and work pressure. Mindfulness, as a dynamic personality trait, refers to a state of alertness and awareness that helps individuals overcome, or at least mitigate, the negative consequences of working under pressure [16–19]. Mindful individuals attend to detail, are willing to consider alternatives, respond to change, are open to novelty, and are oriented in the present [18]. As such, mindfulness is a valuable psychological attribute (or resource) for individuals in managing stressful conditions. In particular, mindful users equip themselves with skills to concentrate on actions that help them alter stressful situations. In other words, they rely more on coping behaviors that deal with finding a solution to alleviate the stress (i.e., problem-focused coping) and maybe less on solutions to regulate their emotions (i.e., emotion-focused coping). However, little is known about the role that mindfulness may play in mitigating stress and work frustration in agile teams, and the mechanism through which such influence may come into effect. Filling this gap is important because recent Information Systems (IS) research has identified mindful use of IT artifacts and procedures as a particularly revelatory individual trait for navigating technology adoption and development in ambiguous and stressful situations [3,20] when using complex IT solutions such as Enterprise Resource Planning (ERP) systems [21] or building IT solutions [3]. Aligned with these findings, we argue that engaging with agile methodologies in a mindful manner is helpful when dealing with stressful situations stemming from the demands and burdens of the agile approach and the potential burnout and frustration associated with that. To examine this premise, we aim to answer *whether and how mindful engagement with agile approaches can alleviate burnout in agile software development projects.*

We draw upon the transactional model of stress and coping (TMSC) [22] to answer our research question. TMSC contends that a person's capacity to cope with a stressful condition is subject to the resources available to them. Available resources enable individuals to use problem-focused coping strategies (i.e., efforts to change the situation) and put less focus on using emotion-focused coping strategies (i.e., efforts to regulate emotional disturbances) [22]. Building upon TMSC, we propose that mindfulness, as a psychological resource and a dynamic personality trait, empowers individuals by influencing their choice of coping behaviors such that mindful users focus more on solving problems at hand and lower their effort to recover their emotional stability when facing challenges in agile software development environment, hence experiencing less burnout.

This study contributes to research and practice in several ways. First, this paper contextualizes mindfulness in the context of agile environments and proposes the notion of *mindful engagement with agile methods (or agile mindfulness)* based on the relevant constructs available in the literature. Second, using TMSC, the paper provides a theoretical explanation of how personal resources such as mindfulness promote desirable coping behaviors (e.g., problem-focused coping behaviors), which eventually reduce perceived burnout. In terms of practical contribution, the empirical findings of this research offer insights for managers and leaders of agile projects to design evidence-based interventions that can curb the stress and burnout in agile teams through promoting the practice of mindfulness in the agile context.

The rest of the paper is organized as follows. Next, we review the literature on stress in agile environments and IS research on mindfulness in the agile ISD setting. Based on this review, we develop the research model and hypotheses in light of TMSC. Then, we present our research method along with our findings and discussion. We conclude by discussing the results, highlighting the contributions to research and practice, limitations, and future directions.

2. Background and relevant literature

2.1. Work stress and exhaustion in agile teams

Evidence from research and practice emphasizes that agile methods increase the quality of the product and facilitate creation of true business value in uncertain and volatile situations [1,23–25]. Predominantly, previous research has been focused on highlighting the bright sides of agile effects and overlooked the potential burdens on agile team members. This does not match the reality of agile projects when evidence from empirical research signals instances of stress and exhaustion amongst developers [9,3,14]. The drive for committing to agile values and principles such as frequent delivery of working product in short iterations, constant and continued communication with multiple stakeholders, and the attempt to accommodate changing requirements may place a level of pressure on developers that could result in negative consequences [3]. However, according to our literature review, to the best of our knowledge, only five empirical studies have explored the consequences of agile ISD practice at the individual level and the potential impact on developers' stress and work exhaustion. Tuomivaara et al. [14] found that agile ISD may lower developers' work exhaustion by balancing their workload more effectively across the entire life cycle of the project (more efficiently than traditional ISD approaches). Windeler et al. [15] reported that the less formal and flatter structure of agile teams increases role ambiguity and role conflict which in turn could increase developers' stress levels. Venkatesh et al. [5] showed that agile ISD can mitigate work exhaustion by fostering a clearer and less

ambiguous role perception, especially for those developers who are skilled with higher organizational and interpersonal competencies. Mueller and Benlian [4] found that the use of agile methods reduces fatigue and turnover via enhancing developers' self-regulatory resources, and that perceived workload strengthens such impact. Lastly, Benlian [3] showed that agile ISD is a double-edged sword that is instrumental to developers' energy sources on some days (by increasing work engagement) but detrimental to their energy and well-being on others (by increasing depletion).

While these five studies shed valuable light on the impact of agile ISD on developers' well-being, we identify two salient but unexplored shortcomings. First, existing research mostly takes a job-demand-control perspective. Their theoretical aim is to understand whether the "*extent*" of using agile practices could provide a means to mitigate developers' stress and enhance their well-being. For example, Mueller and Benlian [4] looked into two specific categories of agile practices, i.e., the extent of using agile *software development* practices (e.g., pair programming and automatic unit tests) and the extent of using agile *project management* practices (e.g., iterative delivery, daily stand-ups, and retrospective meetings). They explored whether the extent of using agile practices in these two specific categories influences developers' fatigue and turnover. In a similar vein, but from a different theoretical standpoint, Venkatesh et al. [5] and Benlian [3] examined whether the *extent* of using agile methods has an impact on the developers' well-being and work exhaustion through role ambiguity, work engagement, and resource depletion. We argue that apart from the *extent* of use of agile methods, it is paramount to note "*how*" agile methods are used by the developers. Are the developers mindful of the correct and true application of agile methods and practices contingent on the situational characteristics of the project and stakeholders? This is an important question given that IS literature has already established that "doing agile" is different from "being agile" [6] whereby the latter refers to mindfulness in using agile methods [26]. Doing agile simply denotes practicing elements of agile methods (to address inefficiencies in traditional ISD methods) whereas being agile focuses on the underlying behaviors from which agility, or a lack thereof, is founded [6,26]. A truly agile team member must cautiously avoid mechanical use of cognitively and emotionally rigid, rule-based behaviors that represent a state of mindless engagement with agile methods [27,28,26]. We, therefore, propose that a mindfulness lens (i.e., whether a developer uses the agile methods in a mindful manner) affords the opportunity to explore the underlying mechanism through which feeling (or absence of feeling) stress and exhaustion is developed.

Second, the relevant literature thus far has not looked into the behavioral coping mechanisms with which the developers may (or may not) succeed in managing and mitigating stress and frustration in agile projects. It is well-established in the literature that coping mechanisms (many of which may run unconsciously in the background of the cognitive system of individuals) can shape different behavioral and psychological consequences in response to the same stressful situation [22]. We therefore draw on the TMSC to foster our understanding of the roles coping behaviors play in shaping the well-being aspects of individuals in agile projects, and their interplay with agile mindfulness.

2.2. Mindfulness in agile software development research

Mindfulness is defined as a cognitive process of alertness and dynamic awareness [16,17]. A mindful person "reacts to events in his or her environment, actively questions existing categories and interpretations, and creates new ones which in turn invoke an increased state of involvement and wakefulness" ([27], p. 122; [16,17]). In contrast, a mindless person is someone who is in a state of reduced attention and becomes entrapped in the old categories where his or her distinctions were drawn in the past [29,27,17]. Mindlessness (or lack of mindfulness) is characterized by rule-governed and rigid behaviors [16] in a way that the person can be perceived to be "on automatic pilot" ([18], p. 4). Lack of mindfulness leads to relying on existing routines and failing to operate from multiple perspectives, which can eventually result in impaired individual performance [16,18]. The role of mindfulness in promoting positive outcomes is well established in the IS literature across a variety of contexts and applications (see [27], for a full review of mindfulness research in IS).

The first appearance of mindfulness in agile system development literature happened when Butler and Gray [30] laid the theoretical ground that the mindset and practices of agile development desire techniques that promote mindfulness. The authors assert that mindfulness theory has the potential to assist agile ISD team members in producing more reliable information systems [30]. Building on this theoretical insight, in 2008, Matook and Kautz [28] delved into the four pairs of values in the Agile Manifesto (2001) (i.e., individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan) and mapped them to the underlying components of mindfulness (i.e., openness to novelty, alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, and orientation in the present) [16,17]. In their study, Matook and Kautz demonstrated that "[exercising] mindful behaviour as part of an ASD[1] approach may contribute to successful ISD" ([31], p. 646). Prior research noted that truly agile teams must engage with agile principles and practices mindfully and not become entangled in mechanical, rule-based, and rigid behaviors when adopting agile methods [3,6,26]. Overall, IS research contends that mindfulness is an appropriate theoretical lens to examine agile software development [31,6,26] given that mindfulness is a process to promote attention to detail, willingness to consider alternatives, responsiveness to change, openness to novelty, and orientation in the present which all exhibit similarities to the principles, values and goals of agile ISD (as per the Agile Manifesto) [31]. Table 1 summarizes the studies that have dealt with the questions on the interplay of mindfulness and agile software development.

These studies (Table 1) provide a wealth of knowledge in relation to mindfulness and agile software development from across a variety of angles. However, empirical evidence for how mindful use and application of agile methods influence people in agile teams is still limited. More specifically, while IS literature signals the lack of mindfulness (or in other words, existence of mindlessness) in implementation and adoption of agile approaches [6] and recognizes its potential negative consequences [31,40,26], research remains largely silent about the potential role that mindfulness may play in alleviating people's stress and work frustration in agile software developments, and the mechanisms through which such a relationship may take place. The only exception is a recent study by Benlian [3] in which the authors showed that mindfulness has a positive moderating role in reducing the burden on software developers in agile projects. Our study follows this new line of inquiry into agile ISD and seeks to examine whether and how engagement with agile methods in a mindful manner may reduce developers' stress and exhaustion. We approach this topic from the angle of the TMSC, as discussed in the following section.

3. Theoretical development

In this section, we first briefly introduce the TMSC and outline how it guides our theoretical basis. Next, we discuss and contextualize the notion of mindful engagement with agile methodologies. Then, we develop the research model and hypotheses (Fig. 1).

3.1. Transactional model of stress and coping (TMSC)

The theoretical foundation of this study is guided by TMSC which

[1] ASD: Agile Software Development

Table 1
Past research on the intersection of mindfulness and agile software development.

Study	Research approach and methodology	Brief description / findings
Dehnert and Santelmann [32]	Quantitative (survey of 179 digital transformation project leaders)	Examined role of individual mindfulness (general trait mindfulness) in the burnout and satisfaction of people in software development projects.
Jafarzadeh and Mosafer [33]	Conceptual	The authors develop a conceptual model and theorize the relationship between mindful use of agile and agile identity and how they may influence the well-being and behaviors of people in agile teams (in terms of performance, burnout, deep use, innovative use, and satisfaction).
Dernbecher and Beck [27]	Systematic literature review	As part of a comprehensive systematic literature review on mindfulness research in IS, the authors identified and analyzed 10 mindfulness papers related to ISD from which six explicitly linked mindfulness to agile methods.
Cram and Newell [34]	Qualitative (case study of 5 organizations)	Applied the concepts from management fashion theory to understand how organizations mindfully (or mindlessly) adopt agile methods and distinguished categories of agile adaptation adoptions: Crusaders (exclusively adopt agile in a pure form), Tailors (integrate agile and traditional approaches), and Dabblers (employ a few ceremonial agile activities alongside a traditional approach).
McAvoy et al. [6]	Qualitative (longitudinal case study)	Introduced the concept of 'doing agile' (use of agile practices to address ISD process inefficiencies) vs. 'being agile' (focuses on the underlying behaviors from which agility, or a lack thereof, is founded). Paper justified that mindfulness is an appropriate lens to examine the ISD agility of an organization.
Nagle et al. [35]	Qualitative (case study)	Through a quantitative analysis triangulated with a qualitative one in a case study, the paper put forward a definition for the aspects (or components) of organizational mindfulness in agile global software development and unveiled the relationships and the interactions between those components.
Ranganath [36]	Conceptual (opinion paper)	In this opinion paper, the author shared his experience in relation to using agile projects and elaborated on how agile teams can elevate from 'doing' agile to 'being' and 'living' agile. He recognized mindfulness as one of the four key factors that should be considered when planning an agile project that is designed to be sustainable (along with purpose, simplicity, and positivity).
Vidgen and Wang [26]	Qualitative (case study)	The paper develops a framework for organizing agile software development by identifying factors that enable or hinder agility in teams. Through the study of two software development teams, the research highlights key enablers such as time pacing and self-management, and inhibitors such as centralized management, while also identifying emergent capabilities of agile teams such as coevolution of business value and collective mindfulness.
McAvoy and Butler [37]	Qualitative (case study)	Through a case study of a large US multinational telecommunications manufacturer, the paper elaborated on mindful and mindless decision makings in software development projects (traditional and agile) and explained how ineffective management of agreement in ISD projects can contribute to the existence of the Abilene Paradox, the consequence of which affects the mindfulness of adoption and review processes in ISD.
Surendra [38]	Action research	The paper examined the application of agile development principles and practices in developing IT innovations, and whether the application of agile methodologies could enable the organization to mindfully adopt that innovation.
Elbanna and Murray [39]	Field work (12 interviews)	Through an analysis of a successful IS project, the paper identifies the importance of creating a "bubble" of collective mindfulness facilitated by agile practices, which fosters business innovation and successful solution delivery, offering practical implications for IS project management and encouraging a mindful organizational approach.
McAvoy and Butler [37]	Qualitative (case study)	Through a case study, the paper investigates mindful and mindless behaviors and decisions by a software development team in the firm-specific post-mortem projects incorporating traditional vs agile ISD, with a focus on the socio-psychological factors influencing decision-making by social actors.
Matook and Kautz [28]	Conceptual paper	The paper develops a framework based on the theory of mindfulness and maps the main characteristics of mindfulness to the most prominent features of agile software development as per the Agile Manifesto.
Benlian [3]	Quantitative (survey of 131 software developers over two weeks)	Drawing on the holistic stress process model, the paper examines whether agile ISD can be a source of stressful situational demands with both energizing and depleting effects that may thus help or harm developer well-being. Amongst other findings, the authors found that IT mindfulness serves as a facilitator of challenge appraisals and as a buffer against threat appraisals.

provides a useful lens to understand how people cope in stressful conditions. TMSC maintains that when people face demands that exceed their resources, they go through a four-step process to cope with the situation: primary appraisal, secondary appraisal, coping, and outcome [22] (also see [41–44]). Based on TMSC, when individuals appraise

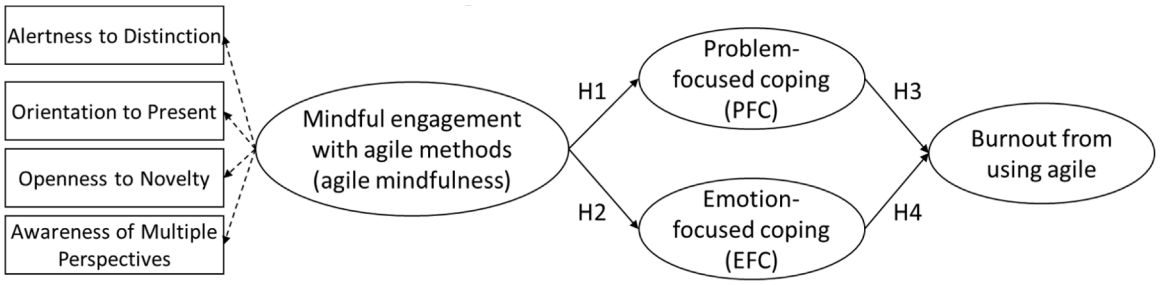

Fig. 1. Research Model.

working in an environment (e.g., agile software development projects in our case) as a negative stressor (i.e., outcome of *primary appraisal*), they begin to evaluate the extent to which they have available resources to inform their coping (i.e., outcome of *secondary appraisal*). *Coping* is a core concept of the theory which is defined as an individual's "*cognitive and behavioural efforts exerted to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person*" ([22], p.141). Subsequently, the more individuals feel they have resources available to them, the more likely they are to take direct actions to manage and resolve stressful conditions, which is known as problem-focused coping (PFC) behaviors. Conversely, the more they believe they lack resources, the more likely they are to engage in behaviors that only help them gain their emotional stability without solving the problem at hand, which are known as emotion-focused coping (EFC) behaviors. Ultimately, the selection and application of these coping strategies may have positive or negative effects on psychological and behavioral *outcomes*. TMSC has been widely used in the IS literature to shed light on stress associated with complex IS such as implementing new IT in organizations [41,45] and information security compliance [46,47].

Building on the principles of TMSC, when software developers appraise using agile methods as a negative stressor (*primary appraisal*), they start to evaluate the extent to which they have resources available to them to inform their coping (*secondary appraisal*). The more they feel they have available resources, the more likely they are to use *problem-focused coping* behaviors. In contrast, the less they feel they have resources, the more likely they are to engage in *emotion-focused coping* behaviors. In light of the main premises of TMCS theory, we theorize mindfulness as a psychological resource that influences individuals' choice of coping behaviors.

3.2. Mindful engagement with agile: applying the concept of mindfulness in the agile context

Mindfulness can be a general trait for a person in their life [48,16,49]. A mindful person is someone who is "*open to innovation and vigilant but at the same time thoughtful and alert to his/her surroundings*" ([48], p. 391). However, being generally mindful in life does not necessarily mean that the person interacts with everything in a mindful manner, for example in dealing with technology-related artifacts and phenomena. This served the basis for Thatcher et al. [19] introducing the notion of IT mindfulness where the authors demonstrated that IT mindfulness is conceptually and operationally distinct from general trait mindfulness in life. Trait mindfulness refers to "*one's propensity to exhibit mindfulness broadly, across situations and time" whereas domain-specific mindfulness "directs attention to a specific situation and/or range of behaviors*" ([19], p. 836). An individual with a high level of trait mindfulness would likely exhibit a tendency to be mindful at all times in general (home, work, and play) but may fail to demonstrate the characteristics of mindful behavior in domain-specific conditions and use cases [50,19]. As such, while some people might be generally mindful, they might not necessarily show high levels of mindfulness in specific interactions with specific artifacts, and hence may fail to maximize the benefits or may miss new opportunities associated with that artifact and/or situation [19]. This distinction between general trait mindfulness and context-specific technology-related mindfulness is reflected in operationalization of the constructs as well where, for example, a statement for general trait mindfulness is "I like to investigate things" [51] whereas the counterpart statement for IT-specific mindfulness is "I like to investigate different ways of using [a particular artifact]" [19].

Given that in our study we intend to specifically investigate the extent to which people deal with agile methods in a mindful way, we argue that the IT mindfulness construct (which concerns the mindful engagement with a particular technology-related artifact) provides a better basis for our study compared to general trait mindfulness (which is concerned with the general state of mindfulness in life). We acknowledge that agile methods are not just IT tools, but they are nevertheless IT artifacts (although soft), hence Thatcher's IT mindfulness construct is more useful for us as it enables gauging mindful interactions with things/artifacts – which is 'agile method' (a soft IT artifact) in our case.

Drawing on the contextualization of mindfulness in the IT context [19], we view agile mindfulness (or mindful engagement with agile) as an overarching mental mindset driven by developers' awareness in the context of software development projects and openness to value-adding applications of agile methods. More specifically, we define agile mindfulness as a dynamic agile-specific trait, evident when working with agile methodologies, whereby the agile team members focus on the present, pay attention to detail, exhibit a willingness to consider other uses, and express genuine interest in investigating features and failures of agile methods. Instead of exhibiting cognitive and emotionally rigid behaviors and pursuing prescriptions and procedures of agile methods in a mechanical fashion [30,34,28,6,26], a mindful member in agile teams thoughtfully reacts to the event in an agile project environment, actively questions existing but incompatible norms (with the situations of the project), seeks alternative interpretations, and creates new alternatives that in turn invoke an increased state of wakefulness and involvement.

Consistent with the multidimensionality of general mindfulness [16,50,18] as well as IT mindfulness [19] constructs, we propose four dimensions for mindful engagement with agile methods — alertness to distinction, awareness of multiple perspectives, openness to novelty, and orientation in the present — all in the context of agile system development.

Alertness to distinction denotes the degree to which an agile team member understands not only the capabilities and features of agile methodologies, but also the context and situation in which agile methods will prove useful. When alert to distinction, agile team members note the discrepancies between their use of the agile methods and the standard potential of the methods. They actively react to such discrepancies by finding new ways to increase incorporation of the mindset, principles, tools, and techniques of agile methods into their system development projects. A more agile mindful team member will effectively recognize the difference between, and the value of, various features, techniques and tools prescribed by agile methods and how they can be effectively used to the benefit of the project. For example, during a daily stand-up meeting, an agile team member might recognize that

the usual focus of the team on status updates is limiting the discussion's effectiveness. Instead of merely reporting on individual progress, they steer the conversation toward identifying blockers and potential solutions, allowing the team to better collaborate on addressing those issues. This shift in focus transforms the daily stand-up from a status reporting ritual to a genuine problem-solving session, thereby improving the flow of the development process. In another example, a team working in a Scrum environment may recognize that during sprint planning, they are spending too much time breaking down tasks into minute details that are unnecessary for the project's needs. A team member with high alertness to distinction may suggest using a broader approach to planning, where the focus is on defining clear goals for the sprint and allowing the team to self-organize around achieving them, rather than micromanaging every single task. This adjustment leads to a more flexible and efficient sprint planning process, which allows the team to maintain a higher level of agility and responsiveness throughout the sprint. Furthermore, when a team member notices that a popular agile practice, like pair programming, is not delivering the expected results for a specific team configuration or project context, they may propose alternating between pair programming and solo work depending on the nature of the task. For instance, a complex coding problem that requires deep individual focus might benefit from a solo approach, whereas tasks that require collaboration, such as code reviews or brainstorming sessions, may be more effective with pair programming. This distinction allows the team to apply agile techniques in a more nuanced way, improving both individual productivity and collaboration

Awareness of multiple perspectives denotes the extent to which an agile team member identifies different points of view regarding how one might use agile methods and understands the distinct value of each potential use. A team member who employs multiple perspectives holds greater potential to create innovative solutions to problems and opportunities found in their project environment, and beyond, that can be addressed through the use of agile methods. A more agile mindful team member may recognize different potential applications of agile methods that may even go beyond their commonly practiced applications within or outside the project. For example, a product owner from the business side of the agile team might recognize that agile practices, typically used in software development, can also be applied to non-technical areas, such as marketing the software product being developed (specially in startup businesses), to improve collaboration and responsiveness. In one case, a Scrum framework could be adapted to manage marketing campaigns by having the marketing team work in sprints to plan, execute, and review campaign efforts, allowing for more iterative and adaptable processes. This perspective broadens the team's view of agile, seeing it not just as a tool for development but as a way to improve overall agility. Furthermore, a team member with awareness of multiple perspectives might suggest blending agile mindset with other frameworks beyond mere software development, such as design thinking [52], to address specific project challenges. For instance, by combining Scrum's iterative approach with design thinking's focus on empathy and user-centric design, the team can create a product that is both innovative and well-aligned with customer needs. Another example might involve a Scrum master who, recognizing the diversity of the team's expertise and experiences, facilitates discussions that encourage individuals to share different viewpoints on how agile practices can be applied. This inclusive approach can lead to more creative solutions and ensure that the team considers a broader range of potential approaches to problem-solving across multiple perspectives.

Openness to novelty denotes agile team members' willingness to explore new features or potential of agile methods. More agile mindful people are open to embracing a wider range of principles, features, techniques, tools, and applications of an agile method. An agile mindful person can manifest this openness by demonstrating curiosity, experimentation, and flexibility in their interaction with agile methods. For example, less agile mindful users may limit themselves to minimal features of agile methods that they are already familiar with or the team/organization obligates them to use. In contrast, more agile mindful people may explore new things in the agile space that are beyond their immediate work needs and obligations. This could range from trying new tools and software for managing agile processes, to using additional plugins and extensions that add to the core features of agile project management tools (such as many third party plugins available for Jira,[2] one of the market leader tools for managing agile projects), attending to additional principles of the agile approach that are not implemented by the team, or experimenting with other counterpart agile methods (in part or in whole) than the one used by the team/organization (e.g., borrowing useful practices from XP or Crystal or even traditional methods in a team that predominantly uses Scrum). For instance, in a project with a high degree of regulatory requirements, an agile team member may decide to adopt a more structured approach to documentation than what is commonly emphasized in agile methodologies, ensuring compliance while maintaining agile flexibility. By this innovation, they adapt the principles of agile to fit the unique context of the project without rigidly adhering to the prescribed methods.

Last, *orientation in the present* denotes the degree to which an agile team member becomes involved in a specific and current context and situation of the agile project in which they work. Being agile mindful means the team members focus on the present and their agile practices vary in response to different contexts and situations in which they operate. For example, a more agile mindful user notes that some aspects and principles of pure agile methods may not be applicable in, or beneficial to, the very specific situation and context of their project. Such users, rather than using agile mechanically on auto-pilot [53], will attend to the 'big picture' of the project and its stakeholders and cherry pick those things from agile practice and mindset that are useful and of benefit to the present conditions of the project. For instance, in a project with tight deadlines and high uncertainty, a mindful agile team member might recognize that while Scrum's prescribed fixed sprint cycles work well in many contexts, in this particular case, a more flexible approach might be more effective in responding to frequent changes and optimizing workflow. The team may decide to eliminate the fixed sprint length and instead focus on continuous flow, adjusting the practices to better meet the demands of the situation. Another example could be implementing ultra-short 'micro-sprints' which could last only 1–2 days (or even shorter) [54], aimed at achieving very specific outcomes, such as bug fixes, user feedback collection, or feature exploration. These micro-sprints allow teams to respond even more quickly to changes and unexpected issues specific to the present situations of the project. By doing so, the team members exhibit a strong orientation in the present, adapting their agile practices to the unique dynamics of their project and working environment.

3.3. Research model development

As discussed earlier, when using agile methods, the people in the team may have to deal with challenges that stem from the intrinsic demands of agile methods. According to TMSC, in such situations, those people who are more mindful in using agile methods have a higher level of psychological resources to appraise the situation in a way that directs them to tackle challenges and undertake problem-focused coping behaviors. A more mindful agile user considers the context and situations in which agile features and practices are (and are not) useful (*alertness to distinction*), is aware of the different perspectives for implementing the same principle of agile in various ways (*awareness of multiple perspectives*), is willingly capable of developing and experimenting new ways of dealing with agile methods (*openness to novelty*), and is more likely to come up with possible innovative alternative solutions to rectify the challenges and pressures associated with use of agile. Such mindful agile users (developers, business analysts, project managers, etc.) tend to

[2] See for example: https://marketplace.atlassian.com/addons/app/jira.

avoid unfit and mechanical use of agile practices with no consideration of the real situations of the project and organization, and seek to develop purposeful initiatives and solutions towards maximizing the benefits of the projects and the customers [55,56,5], for example by applying the practices and principles of agile selectively, in a different sequence than standard procedures, or in combination with (or alongside) traditional plan-driven approaches [57,34,55]. Thus, we propose:

H1: Mindful engagement with agile methods is positively associated with problem-focused coping in agile system development.

TMSC also maintains that when individuals perceive they do not possess adequate resources (physical or psychological) to tackle the challenges of highly demanding work environments, they are more likely to develop negative emotions (such an anxiety, helplessness, and frustration) and subsequently engage in emotion-focused coping strategies that primarily intend to regulate emotions (rather than actually trying to solve the problem at hand), for example by blaming themselves or others, aggression, distancing, avoidance, and withdrawal [58–60]. With a similar line of argument, individuals with lower levels of mindfulness, as a psychological resource, are less able to consider and analyze the situation in which applying agile principles and practices is beneficial (lack of the *alertness to distinction)* and have less potential to think "outside the box" to explore new ways of adopting and adapting agile methods (lack of *awareness of multiple perspectives*) according to the true needs of the project, organization, and the team at the time (lack of *orientation in the present*). Subsequently, these agile users have a higher potential to become involved in emotion-focused coping due to the likelihood of experiencing extreme negative emotions such as anger. Hence, we hypothesize:

H2: Mindful engagement with agile methods is negatively associated with emotion-focused coping in agile system development

TMSC suggests that problem-focused coping behaviors promote positive results and reduce the likelihood of experiencing negative work outcomes as they help people solve the actual problems [22]. This has been examined and validated across various IT and other contexts. For example, Zhao et al. [60] report that seeking instrumental support (which is an instance of problem-focused coping) is positively associated with increasing employees' performance when using IT. Similar positive links have been observed between achieving higher productivity and task modification (a type of problem-focused strategy) when people in virtual teams face challenges associated with use of technology [61], as well as between employees' efficiency and technology adaptation (e.g., system upgrade) or staff upskilling which are both examples of problem-focused actions [45]. While most of the studies in IS literature examined the relation between problem-focused coping and positive outcomes (e.g., performance and productivity) [45,61,62,60], empirical evidence for the role of problem-focused coping in mitigating adverse work outcomes also exists. For example, [63] show that, in stressful conditions due to the use of new IT systems, employees feel less exhausted if they are open to adapting existing routines and seek support from peers. In a medical context, Ogoma [64] reports that problem-focused coping reduces medical students' burnout associated with an overly heavy study load from the university. Following this body of literature, and guided by TMSC, we suggest that problem-focused coping strategies are likely to reduce the potential for experiencing work exhaustion and burnout from using agile methods in software development projects, and hypothesize:

H3: Problem-focused coping strategies reduce work exhaustion associated with use of agile methods.

Lastly, according to TMSC, although there are some benefits in being aware of the emotions associated with stressful conditions or trying to avoid them [65], emotion-focused mechanisms result in people not taking any actions toward solving the problem, and thus lead to unfavorable work outcomes because the main problem remains unresolved [66,60]. The literature provides a multitude of evidence that poor or negative outcomes (e.g., performance deficiency or exhaustion) occur when people implement emotion-focused strategies such as withdrawal and aggression [58], avoidance [45], blaming the situation or others [67], and behavioral disengagement or denial [63]. In line with the premises of TMSC together with evidence from the literature, we posit that those agile method users who implement emotion-focused strategies are more likely to suffer from work exhaustion and burnout in the agile system development environment because they leave the actual problems unsolved and have to continuously struggle with the issues. Thus, we hypothesize:

H4: Emotion-focused coping strategies increase work exhaustion from using agile methods.

4. Methodology

4.1. Operationalizations and measurement

4.1.1. Mindful engagement with agile methods (agile mindfulness)

We adopted the measures for 'mindful engagement with agile' from Thatcher et al. [19] and tailored them to the context of agile ISD. As discussed earlier, the reason for adapting our items from IT mindfulness, rather than general trait mindfulness [51], was the need to measure mindful engagement with *things* (agile methods in our case) rather than a general state of mindfulness in life. In the pre-test phase of the study, we assessed the suitability of the adapted items with four academics (who were experienced in designing surveys and in agile software development) and five professional members of agile teams to ensure the items make sense in the context of agile ISD. We measured this construct with 12 items using a seven-point Likert scale of 'strongly disagree' to 'strongly agree'(same Likert scale was used to measure all constructs in the model).

4.1.2. Problem-focused and emotion-focused coping behaviors

Coping is highly contextual. As such, the selection of coping behaviors should fit the context of their occurrence [22]. Developing software in agile environments deals with solving complex and relatively unforeseeable problems, which involves close interaction and collaboration with team members. Teams using agile methods hold multiple short meetings for planning, assigning tasks and other purposes. The focus on social interactions in such environments motivates individuals to use coping behaviors that involve other team members when facing adversities in addition to their own efforts in managing stress. Thus, we expect that individuals use self- and social-driven coping behaviors. Self-driven coping behaviors include actions individuals take themselves to deal with stressful conditions. Social-driven coping behaviors describe actions taken to deal with a stressful condition using help from others.

Because coping behaviors include both self and social dimensions and are not expected to be replaced by each other, we measured problem-focused coping and emotion-focused coping behaviors as formative second-order constructs. For problem-focused coping, we measured active coping as a common self-driven coping behavior. We took measures from Carver et al. [68] and adapted the items to our context. We also used seeking instrumental support as a social-driven coping behavior. We took these measures from Carver et al. [68] and adapted them to the context of our study. For emotion-focused coping, we used venting and seeking social support as self and social-driven coping behaviors, respectively. The measures were adapted from Carver et al. [68] with contextual adaptation. Our approach in dealing with coping behaviors as formative second-order constructs is backed up by similar studies in the literature e.g., Liang et al. [69]. We used 4 items

to measure each coping strategy.

4.1.3. Work exhaustion and control variables

To measure team members' burnout from using agile methods, we adopted items from [21]. We used 8 items to measure burnout in this study. We also controlled for age, gender, education level, experience with agile methods, role in the team, agile methods used, expertise in agile use (self-perception), and extent of using agile versus traditional methods in the projects (self-evaluation).

4.2. Study setting and participants

To assess our research model, we collected data using an online survey. We recruited our participants, using Qualtrics, a data collection company specialized in recruiting internet-based survey panels. A panel of IT and software development professionals in Australia were invited to participate. Qualtrics utilizes a combination of proprietary panels and partnerships with vetted third-party sources to recruit participants. Individuals are invited to join these panels through various channels. Upon expressing interest, potential panelists complete a profiling survey that collects demographic and professional information. This data enables Qualtrics to match participants to studies based on specific criteria—in our case, current employment in IT or software development roles in Australia. To ensure data quality and respondent authenticity, Qualtrics employs several quality control measures. These include digital fingerprinting to prevent duplicate entries, attention checks within surveys to ensure engagement, and ongoing monitoring of response patterns to identify and remove low-quality responses. Additionally, panelists are regularly re-profiled to maintain up-to-date information, and their participation is managed to prevent survey fatigue and over-solicitation. This approach for data collection via Qualtrics or similar providers has been successfully employed by many previous IS studies (e.g., [3,7]). To ensure suitable respondents participate, eligibility questions were included at the beginning of the survey, asking them if they are currently using agile methods in their system development projects or have used agile methods in the last three years. Their use of agile methods could be full adoption of agile methods, partial adoption, or using agile methods in combination with non-agile approaches. All members of agile teams were eligible to participate in the study. Those who failed to meet the eligibility criteria were excluded from the survey.

Quality control measures (attention check questions, speeder detectors, etc.) were practised, and those respondents who did not meet the criteria were removed from the study. In total, we collected 319 complete and useful responses from the participants. The respondents' demographic information is shown in Table 2. The gender distribution of respondents was fairly balanced (slightly more men). Seventy-four percent of respondents had at least 2 years of experience with agile methods, and 38 % had >5 years. The majority of respondents (58 %) used agile methods highly or very highly, and 33 % moderately. Scrum was the most widely used agile method. Over 90 % of respondents considered themselves at least moderately expert in using agile methodologies (self-report), out of which 51 % see themselves as highly or very highly expert. Respondents demonstrated a wide range of roles in agile teams from project managers and scrum masters to business analysis and technical people. Overall, our sample represented a reasonable set of characteristics for the target population, however, as with any research, the generalizability of the outcome should be in light of the attributes of the respondents.

Table 2
Demographic information of respondents.

Demographic information	Category	%
Gender	Female	44
	Male	54
Age	Under 30	16
	30 to 39	47
	40 to 49	27
	50 and over	9
Education	High school graduate or lower	11
	Bachelor's degree	50
	Master's degree	27
	Doctorate degree and higher	9
	Other	2
Current role in agile project*	Project manager/leader, Scrum master	54
	Developer, technical person	27
	Business analyst	23
	Product owner, customer representative	14
	Other	4
Experience in using agile	<6 months	3
	6 months to 1 year	6
	1 to 2 years	17
	2 to 5 years	36
	5 to 10 years	30
	>10 years	8
Agile methods currently used*	SCRUM	59
	XP (eXtreme Programing)	46
	Crystal	39
	Lean	26
	Kanban	22
	Other	3
Expertise in agile methods	No experience at all	0
	Minimal	8
	Moderately expert	40
	Highly expert	35
	Very highly expert	16
Extent of development based on agile methods	Not at all based on agile methods	0
	A little	8
	Moderately	33
	Highly	40
	Very highly based on agile methods	18
Use of agile tools*	JIRA	38
	Trello	37
	Spreadsheets (e.g., Excel, Google sheets)	72
	Monday.com	34
	Confluence	21
	Other	1

* Multiple choice categories.

5. Analysis and results

5.1. Treating second-order constructs

Agile mindfulness, PFC and EFC were second-order constructs (the first is reflective; the other two are formative). To incorporate these multidimensional constructs into our analysis, we employed a hierarchical modelling approach in which both lower-order (e.g., active coping and SSI) and higher-order constructs (e.g., PFC) are included in the model but only higher-order constructs are linked to other variables [70,71]. To measure the reflective second-order constructs, a repeated indicator approach was used whereby each item is assigned once to the lower-order and once to the respective higher-order construct [72–74]. For formative ones, a two-step approach was used which involved estimating the measurement model for the first-order constructs separately and then using the composite scores of the first-order constructs as indicators for the second-order constructs [75].

5.2. Measurement model analysis

Confirmatory Factor Analysis (CFA) was used to assess the quality of the measurement model (see Table 3). Items' reliability was satisfactory (item loadings and composite reliability greater than 0.7) [76,77]. Convergent validity was also satisfactory (average variance extracted – AVE – greater than 0.5) [78,79]. Finally, discriminant validity was satisfactory as well given that the square roots of AVEs was greater than

Table 3
Analysis of the measurement model.

Construct	Items	CR[a]	AVE	Item loading
Alertness	I find it easy to create new and effective ways of using agile methods.	0.84	0.64	0.82
	I am very creative when using agile methods.			0.79
	I make many novel contributions to my work-related tasks through the use of agile methods			0.80
Orientation	I often notice how other people or teams are using agile methods	0.82	0.60	0.80
	I attend to the 'big picture' of a project when using agile methods			0.75
	I 'get involved' when using agile methods			0.77
Openness	I like to investigate different ways of using agile methods.	0.82	0.60	0.76
	I am very curious about different ways of using agile methods.			0.76
	I like to figure out different ways of using agile methods.			0.81
Awareness	I am often open to learning new ways of using agile methods.	0.82	0.60	0.80
	I have an open mind about new ways of using agile methods			0.76
	I use agile methods in many different ways to support my work.			0.76
Active coping	When I experience agile-related problems at work: I take additional action to try to get rid of the problem.	0.83	0.58	0.70
	I concentrate my efforts on doing something about it.			0.76
	I do what has to be done, one step at a time.			0.78
	I take direct action to get around the problem.			0.77
Instrumental social support seeking	When I experience agile-related problems at work: I ask people who have had similar experiences what they did.	0.84	0.56	0.78
	I try to get advice from someone about what to do.			0.70
	I talk to someone to find out more about the situation.			0.79
	I talk to someone who could do something concrete about the problem.			0.76
Emotional social support seeking	When I experience agile-related problems at work: I talk to someone about how I feel.	0.88	0.65	0.69
	I try to get emotional support from friends or relatives.			0.83
	I discuss my feelings with someone.			0.84
	I get sympathy and understanding from someone.			0.86
Venting	When I experience agile-related problems at work: I get mad and tell everyone about problems.	0.90	0.69	0.83
	I lose my temper and curse.			0.83
	I take my problems out on my family, my friends, and other people.			0.88
	I let my feelings out.			0.77
Burnout	I feel emotionally drained by my work in agile projects.	0.96	0.73	0.82
	I feel like my work in agile projects is breaking me down.			0.85
	I feel frustrated with my work in agile projects.			0.86
	I feel I work too hard on my job in agile projects.			0.86
	It stresses me too much to work on my job in agile projects.			0.84
	I feel like I am at the end of my rope in agile projects.			0.86
	I feel burned out from my work in agile projects.			0.89
	I feel used up at the end of the workday in agile projects.			0.88

[a] Composite Reliability.

the correlation with other constructs (Table 4). We also checked Heterotrait-Monotrait (HTMT) Ratio values to assess discriminant validity [80]. As shown in Table 5, the HTMT analysis confirms that most constructs demonstrate strong discriminant validity, with the majority of values falling below the stricter threshold of 0.9. Notable examples include Active Coping and Alertness (0.68) and Awareness and Burnout (0.24), which highlight clear distinctions between these constructs. While a few items slightly exceed the stricter threshold, these overlaps can be theoretically justified, as both pairs reflect related coping and adaptive strategies, which are conceptually complementary rather than redundant. Furthermore, Table 6 presents the cross-loading table. Based on the results, the loading of the items on their own constructs was greater than loadings on any other constructs [79].

5.3. Common method bias (CMB)

We used both procedural and statistical remedies to assess CMB. First, based on recommendations by Podsakoff et al. [81], we paid special attention to the design of the survey to minimize the effects of CMB by ensuring the respondents that the survey is anonymous. We also separated measurement of the independent and dependent variables, so they did not appear in a linear order, paid careful attention to the structure of the survey and item wording to make sure it was not ambiguous and was easy to comprehend. We carried statistical treatments as well. We conducted Harman's single factor test (Harman 1976), which indicates whether the majority of the variance can be explained by one single factor. The rule of thumb is that all items in the theoretical model should not account for more than 50 % of the variance by one factor. The results from exploratory factor analysis identified multiple factors, with the first factor explaining 22.06 % of the variance, indicating that CMB is not an issue in this study.

5.4. Structural model analysis

Partial Least Squares (PLS) [82,83] with nonparametric bootstrapping of 5000 replications was undertaken for path analysis (using SmartPLS V.4) [84]. The summary of PLS path analysis is shown in Fig. 2 including the path coefficients, significant of the α for each hypothesized relationship, and the R-square. The relationships between the constructs were all statistically significant (at $\alpha = 0.001$ for H1, H3 and H4, and at $\alpha = 0.01$ for H2). The direction of the relationship between the constructs matched the hypothesized directions in the research model, except for H2 (mindful engagement with agile and EFC) which was supported in the opposite direction. No statistically significant role for the control variables was observed. The results are discussed in the following section.

Table 4
Interrelation of latent variables.

	Active Coping	Alertness	Awareness	Burnout	Openness	Orientation	Emotional Support seeking	Instrumental Support Seeking	Venting
Active coping	**0.74**								
Alertness	0.52	**0.80**							
Awareness	0.57	0.64	**0.78**						
Burnout	−0.13	−0.16	−0.20	**0.86**					
Openness	0.61	0.68	0.67	−0.14	**0.78**				
Orientation	0.66	0.65	0.67	−0.06	0.72	**0.77**			
Emotional SS	0.45	0.50	0.39	0.08	0.47	0.52	**0.81**		
Instrumental SS	0.68	0.45	0.49	−0.12	0.62	0.58	0.49	**0.75**	
Venting	−0.11	−0.02	−0.07	0.58	−0.06	−0.02	0.20	−0.16	**0.83**

Square root of AVE on the diagonal.

Table 5
HTMT table.

	Active Coping	Alertness	Awareness	Burnout	Openness	Orientation	Emotional Support Seeking	Instrumental Support Seeking	Venting
Active Coping									
Alertness	0.68								
Awareness	0.76	0.81							
Burnout	0.17	0.20	0.24						
Openness	0.81	0.86	0.87	0.17					
Orientation	0.88	0.83	0.86	0.08	0.94				
Emotional SS	0.58	0.62	0.49	0.07	0.60	0.66			
Instrumental SS	0.92	0.58	0.65	0.15	0.81	0.77	0.63		
Venting	0.14	0.02	0.09	0.68	0.07	0.02	0.25	0.20	

Table 6
Cross-loading of the items in the constructs.

	Active Coping	Alertness	Awareness	Burnout	Openness	Orientation	Emotional Support Seeking	Instrumental Support Seeking	Venting
Alert1	0.39	**0.83**	0.52	−0.16	0.54	0.52	0.37	0.30	−0.02
Alert2	0.40	**0.81**	0.53	−0.15	0.53	0.50	0.405	0.31	−0.02
Alert3	0.50	**0.81**	0.53	−0.14	0.61	0.57	0.48	0.48	−0.02
Aware1	0.49	0.48	**0.81**	−0.21	0.55	0.55	0.22	0.36	−0.09
Aware2	0.41	0.51	**0.76**	−0.23	0.51	0.47	0.2	0.34	−0.15
Aware3	0.43	0.52	**0.76**	−0.09	0.54	0.53	0.45	0.49	−0.02
Burn1	−0.17	−0.20	−0.15	**0.82**	−0.14	−0.08	0.05	−0.06	0.45
Burn3	−0.09	−0.10	−0.19	**0.87**	−0.05	−0.03	0.07	−0.05	0.48
Burn4	−0.18	−0.19	−0.25	**0.87**	−0.13	−0.10	0.05	−0.16	0.54
Burn5	−0.11	−0.13	−0.17	**0.86**	−0.08	−0.05	0.02	−0.07	0.46
Burn6	−0.14	−0.18	−0.23	**0.85**	−0.21	−0.12	0.03	−0.16	0.53
Burn7	−0.10	−0.08	−0.15	**0.87**	−0.12	0.01	0.15	−0.11	0.53
Burn8	−0.13	−0.20	−0.17	**0.89**	−0.18	−0.09	0.04	−0.11	0.57
Burn9	−0.14	−0.20	−0.25	**0.88**	−0.18	−0.09	0.00	−0.15	0.53
Coping1	**0.71**	0.36	0.41	−0.11	0.47	0.48	0.34	0.47	−0.08
Coping2	**0.76**	0.43	0.44	−0.17	0.49	0.57	0.33	0.54	−0.16
Coping3	**0.70**	0.36	0.40	−0.03	0.45	0.45	0.25	0.44	−0.07
Coping4	**0.79**	0.40	0.46	−0.11	0.37	0.43	0.33	0.42	−0.10
Open1	0.45	0.57	0.57	−0.19	**0.78**	0.53	0.38	0.46	−0.03
Open2	0.45	0.49	0.55	−0.11	**0.79**	0.56	0.35	0.45	−0.04
Open3	0.55	0.58	0.52	−0.08	**0.84**	0.68	0.39	0.56	−0.14
Orient1	0.56	0.51	0.53	−0.02	0.58	**0.80**	0.41	0.53	0.00
Orient2	0.51	0.54	0.50	−0.11	0.57	**0.76**	0.36	0.41	−0.05
Orient3	0.48	0.46	0.53	−0.06	0.57	**0.77**	0.37	0.43	−0.10
Emot1	0.45	0.45	0.39	−0.09	0.46	0.46	**0.73**	0.51	0.05
Emot2	0.30	0.37	0.30	0.12	0.34	0.41	**0.83**	0.33	0.22
Emot3	0.34	0.41	0.29	0.07	0.37	0.38	**0.87**	0.38	0.19
Emot4	0.34	0.43	0.37	0.06	0.38	0.41	**0.85**	0.38	0.22
Instru1	0.50	0.33	0.34	−0.13	0.47	0.43	0.33	**0.74**	−0.17
Instru2	0.47	0.29	0.37	−0.10	0.40	0.36	0.31	**0.73**	−0.15
Instru3	0.49	0.35	0.39	−0.04	0.54	0.52	0.40	**0.78**	−0.09
Instru4	0.47	0.36	0.43	−0.13	0.43	0.45	0.38	**0.76**	−0.10
Vent1	−0.07	−0.03	−0.08	0.54	−0.04	−0.01	0.22	−0.13	**0.85**
Vent2	−0.14	−0.03	−0.10	0.57	−0.08	−0.06	0.16	−0.15	**0.82**
Vent3	−0.13	0.01	−0.13	0.54	−0.10	−0.04	0.16	−0.18	**0.88**
Vent4	−0.13	−0.04	−0.06	0.33	−0.07	−0.10	0.18	−0.10	**0.78**

Bold font denotes loading on own construct.

6. Discussion of results

In this research, we studied whether and how mindful engagement with agile approaches is associated with the burnout of individuals working in agile software development projects. To do so, we contextualized the notion of agile mindfulness and used it to develop and test a

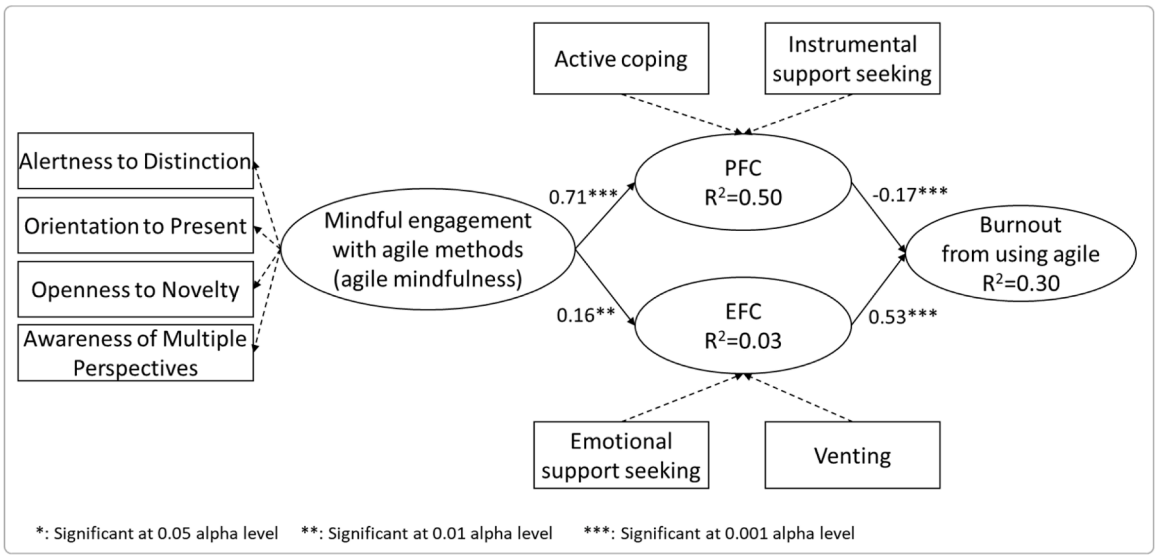

Fig. 2. Results.

research model drawing on TMSC theory. We proposed that mindful individuals are more likely to cope with burnout from using agile approaches by the means of undertaking appropriate PFC and EFC initiatives. It is important to acknowledge that the relationships observed in this study are correlational and do not imply causality. Thus, while we report statistically significant associations among variables, these results cannot be interpreted as demonstrating causality. Several potential confounding factors—such as individual personality traits, contextual stressors outside of the agile work environment, and organizational constraints—could plausibly account for the observed relationships. For example, a general disposition toward mindfulness might influence both how individuals engage with agile practices and how they choose to cope with stress, without a direct causal mechanism between these constructs. While previous literature has proposed theoretical links suggesting potential causal directions (e.g., [85,86]), our data do not permit definitive causal conclusions.

The results of this study showed that mindful engagement with agile methods, as a dynamic coping resource, is positively related to individuals' capacity to effectively apply constructive coping mechanisms that tend to address the problem at hand (PFC) ($\beta = 0.71$, $p < 0.001$). This, in turn, is linked to lower potential burnout and exhaustion in agile environments ($\beta = -0.17$, $p < 0.001$). More specifically, our results showed that mindful individuals utilize different strategies to deal with stress in agile environments. For instance, individuals may rely on their capabilities to identify solutions to solve such issues (i.e., active coping). In addition, because agile environments are highly team-oriented, mindful individuals may seek instrumental help from their peers to actively look for the opinions of others to solve issues, which may be related to lower burnout. Consistent with prior IS research which studied the link between mindfulness and stress (e.g., [85,87,88,86]), the findings of this study provide insights into the coping mechanisms through which mindfulness might mitigate the negative outcomes of working under stressful situations specifically in the agile project environments.

We did not initially expect that mindful individuals would cope with burnout through EFC efforts, as we hypothesized that mindful engagement with agile approaches is negatively associated with emotion-focused coping strategies (H2). The results showed this relationship is significant but in the opposite direction as was hypothesized ($\beta = 0.16$, $p < 0.01$). This is an interesting finding as it suggests that individuals' mindful engagement with agile methods may also be linked to increased EFC efforts, which in turn are positively associated with burnout ($\beta = 0.53$, $p < 0.001$). A possible explanation for this phenomenon could be that mindful individuals are aware of the pressure and stress inherent in agile methodologies, and instead of solving the problem at hand (which in some cases could be extremely difficult due to the nature of agile issues in practice), they try to gain emotional stability by venting or seeking emotional support. For example, agile approaches embrace changing requirements even late in the project (agile Principle 2). Developers are expected to demonstrate a welcoming attitude when users ask for changes and should be prepared to revise the code accordingly. While this is the nature of agile development, redoing code is nevertheless burdensome. In such a situation, a developer has no option to solve the problem at hand (i.e., avoiding redoing code) given that redoing code is an integral part of the agile approach to accommodate users' changing requirements. In the absence of a feasible PCF option, a developer with a high level of mindfulness may recognize this inherent limitation associated with the situation and turn to EFC solutions to, at least, regain their emotional stability. For instance, they may turn to their teammates to seek emotional social support to address the situation, or merely to regulate their emotions.

Again, despite the correlational nature of our study, we find it useful to explore the implications of our results as if the observed relationships were causal, in order to stimulate future research and practical discussion. However, we caution readers that these implications may not hold if causality is not present, and should therefore be interpreted with care.

6.1. Contributions to theory

This research contributes to theory in agile ISD in three specific ways. First, it is amongst the early attempts to highlight and contextualize agile mindfulness (or mindful engagement with agile methods) as a dynamic coping resource in the agile software development body of research. Since being generally mindful in everyday life does not essentially translate into engaging with everything in a mindful manner, our intention was to explore whether a mindful use of agile methods (that is when the user is in a state of alertness and awareness when engaged with agile approaches, pays attention to detail, and exhibits a willingness to consider innovative and situation-specific applications of agile principles and procedures) plays a role in alleviating the burnout and frustration from using agile methods. The results of this study validated this premise which could pave the way for future studies to further examine the behavior of individuals in agile teams using context-specific agile-related mindfulness, compared to their general mindfulness. Overall, our findings strengthen the empirical evidence for the prior theoretical understanding in the IS literature that the nature of

agile development and its principles call for a mindset that embraces mindfulness [30], and that mindfulness theory could help agile ISD teams produce more reliable systems [28,26]. Our results underscore that truly agile teams need to engage with agile principles mindfully, avoiding rigid, rule-based behaviors that hinder flexibility and responsiveness [3,6,26]. Instead, the team should encourage attention to detail, openness to change, and present-moment orientation, which align with the core values and goals of mindfulness [34,33]

Second, our study also contributes to the potential drawbacks of using agile methods for the health and well-being of individuals in agile teams (i.e., [3,4,14,5,15]). Building on TMSC, we provided a theoretical explanation of how mindfulness (as a personal dynamic resource) may promote desirable coping behaviors (problem-focused and emotion-focused) which eventually could reduce perceived burnout and work exhaustion. More specifically, our results supplement recent theoretical findings that, even under the same sort of organizational or project-level conditions in agile software development, the differences in the individual perceptions or cognitive characteristics of developers can lead to adverse job feelings in terms of satisfaction, burnout, or similar. For instance, the role of perceived role ambiguity [5], perceived workload [4], and perceived team support [89] was already proven significant is shaping agile developers work exhaustion. Our findings expand this line of theoretical understanding by showing that personal traits – mindfulness when using agile methods in this case, may plays the same role.

Third, the present study adds to the previous body of research on the positive outcomes of mindfulness in agile environments by providing a theoretical explanation of *how* mindfulness reduces burnout rather than *what it does (or extent of use)*. Benlian [3] has already shed light on the *primary appraisal process* of facing stressors in agile environments by showing that less IT mindful developers are more likely to consider agile methods as threatening, which promotes a state of resource depletion and in turn results in reduced well-being of agile team members. Likewise, Benlian [3] found that more IT mindful developers in agile environments are more prone to evaluate agile approaches as challenging, thus fostering a state of work engagement which consequently increases agile team members' well-being. In other words, mindfulness is a key factor during the primary appraisal. Our research advances a similar stream of research by highlighting the role of mindfulness (i.e., agile mindfulness) in the *secondary appraisal* of the TMSC model. Our research shows that individuals consider agile mindfulness a valuable resource that helps them manage stress. In line with our theorization, agile mindfulness empowers individuals to explore different solutions that help them directly solve issues due to working in an agile environment. These solutions may range from taking actions on their own or involving others.

6.2. Contributions to practice

While our findings are correlational, we believe it is valuable to explore their potential practical relevance. Accordingly, the following suggestions are intended to stimulate discussion and inform future research and experimentation, rather than to prescribe definitive solutions. Practically, this study can also offer insights for managers and leaders of agile teams to design and implement evidence-based intervention programs aimed at reducing stress and burnout by promoting agile mindfulness as a dynamic coping resource in software development environments. This becomes particularly relevant as not all personality traits are easily influenced by training and experience – some are stable and unlikely to change over time, while others, like mindfulness, are dynamic and can be fostered or manipulated in individuals. Research also shows that dynamic context-specific personality traits have the strongest influence on the perception of technostress, compared to broad and stable context-specific traits [21]. Hence, the findings of this study highlight the role of agile mindfulness as a dynamic personality trait that can help managers to mitigate the stress and burnout in agile team members more effectively by understanding how mindful engagement with agile methods enhances both problem-focused coping and emotion-focused coping strategies. To implement mindfulness interventions, emphasizing its four dimensions of alertness to distinction, awareness of multiple perspectives, openness to novelty, and orientation in the present, leaders may consider the following specific actions and recommendations.

To promote *alertness to distinction*, leaders can help agile team members develop a deeper understanding of agile capabilities, and the contexts in which they prove most useful. This can be achieved through scenario-based training, workshops, and case studies that encourage teams to identify discrepancies between standard agile practices and their specific project requirements. Leaders can organize role-playing exercises where team members analyze real-world situations, exploring when and how to apply agile principles in flexible, situation-specific ways. Encouraging team members to document and share examples of successful customizations of agile methodologies in their projects can also foster a deeper understanding of how agile principles can be flexibly applied. *Awareness of multiple perspectives* can be enhanced through brainstorming sessions, peer coaching programs, and inviting external experts and agile practitioners to share innovative and alternative uses of agile methodologies, broadening the team's understanding of diverse approaches. Finally, encouraging role rotation within teams—such as rotating facilitation of agile ceremonies—can help team members gain exposure to new perspectives and uncover innovative ways of applying agile principles.

To foster *openness to novelty*, leaders can encourage team members to dedicate time during sprints for experimentation with new tools, plugins, or agile techniques beyond their immediate work needs. For example, teams can explore third-party Jira extensions or alternative agile practices, such as borrowing useful elements from XP or Crystal, even if their primary approach is Scrum. Leaders can also organize innovation sessions where team members experiment with novel features or processes and share their findings. Recognizing and rewarding curiosity and flexibility—such as trying new applications of agile principles or suggesting process improvements—further motivates team members to embrace innovation and explore the unrealized potential of agile methodologies. *Orientation in the present* can be supported by including reflective exercises in agile ceremonies such as daily stand-ups, retrospectives, or sprint planning, where team members discuss specific challenges and identify which agile practices were most relevant and beneficial to the current project context. They can also discuss how mindful problem-solving or emotional regulation helped them address these issues. Additionally, integrating mindfulness prompts into tools like Jira or Trello can encourage members to pause and reflect on their strategies before taking action, reinforcing mindful engagement. Drawing on the findings associated with the first and third hypotheses of this research, being mindfully engaged with agile methods can help individuals avoid burnout by using active coping and instrumental support-seeking strategies. Thus, by embedding the recommendations provided above, leaders can empower teams to effectively utilize problem-focused coping strategies, reducing burnout and improving the overall well-being of their agile teams. Furthermore, studies suggest that fostering mindfulness can also yield the side benefit of improving task performance, especially in the case of complex tasks [90].

An unexpected finding of this study was the positive association between agile mindfulness and EFC strategies, which may sometimes worsen burnout. This suggests that mindful individuals, while aware of their limitations in solving certain issues (e.g., redoing code due to evolving requirements), may turn to venting or seeking emotional support to manage stress. To address this, leaders can provide structured opportunities for emotional expression and regulation. For example, they can host regular sessions where members can share emotional challenges and receive peer or managerial support. Agile leaders can also offer tailored workshops that teach team members how to process emotions constructively and seek reflective practices instead of venting.

Providing resources such as counseling or coaching services can also help team members regulate emotions effectively and mitigate the risk of burnout.

Aligning the recommended mindfulness practices with agile principles can make these initiatives more organic and effective. For example, in line with the manifesto and principles for agile software development, our findings highlight the importance of *Continuous attention to technical excellence and good design* (Principle 9) and regular *reflections on how to become more effective* (Principle 12). These principles align closely with the values of agile mindfulness, as they emphasize thoughtful, present-focused engagement and adaptive responses to project needs. Additionally, our findings highlight the value of *daily collaboration between business people and developers* (Principle 4) and the value of *face-to-face conversations* to exchange information effectively and efficiently (Principle 6). These principles naturally support the development of instrumental and emotional support systems within teams—key coping mechanisms we found to be influential in mitigating burnout in agile environments. By fostering mindful collaboration, open communication, and continuous reflection, leaders can integrate agile mindfulness seamlessly into agile practices, creating a work environment that burnout and pressure on agile software development teams.

6.3. Limitations and future research

As with any study, our research has limitations that could inspire future studies. Most notably, the cross-sectional design restricts our ability to draw causal conclusions from the observed associations between agile mindfulness, coping strategies, and burnout. While our theoretical framework and prior literature suggest directional relationships, our data cannot confirm whether agile mindfulness leads to changes in coping behaviors or burnout levels, or whether other factors might drive these associations. Potential confounding variables—such as dispositional mindfulness, personality traits, external stressors, or organizational constraints—could influence both how individuals engage with agile practices and how they respond to stress. Future studies should aim to examine these third variables more directly and adopt longitudinal or experimental designs to test causal mechanisms and temporal dynamics more rigorously. Thus, a longitudinal study could provide insights into the directionality and evolution of these relationships over time. Additionally, such data could uncover whether the effects of agile mindfulness on burnout are immediate or develop gradually over time as individuals practice agile mindfulness. However, in line with the causal logic of TMSC [22], self-reported data were appropriate since individuals can better reflect their perceptions when studying chronic stressors. At the same time, we encourage future research using alternative approaches to supplement self-reported measures, such as experiments in controlled settings.

Second, while we focus on how agile mindfulness influences burnout, we do not suggest how to improve individuals' agile mindfulness. Considering the findings of this research that mindful engagement with agile approaches can increase individuals' capacity to cope with stressful conditions in agile projects, future studies could investigate mechanisms to increase agile mindfulness. This would be a valuable research stream, as it has potential to reduce the amount of burnout experienced by agile teams and increase individuals' well-being. Furthermore, prior studies show that IT mindfulness serves as "a facilitator of challenge appraisals and as a buffer against threat appraisals" in stress appraisal processes of developers working in agile teams [3]. This becomes even more important as there are no guidelines to foster this IS-specific mindfulness – except for the tools originally derived from general mindfulness research, like training [21]. Benefiting from other methods such as longitudinal studies provide opportunities for new insights.

Third, we modelled coping strategies as formative variables to understand the holistic effect of coping strategies. This is true given that individuals rely on multiple coping strategies, and they cannot be replaced by each other [91]. However, our research model provides little insight about which coping behaviors are better or what combination of coping strategies individuals use to create the synergic effect in order to reduce burnout. Future research can enhance our understanding using newer methods such as fuzzy-set qualitative comparative analysis (fs-QCA) [92] to identify the combinations of coping strategies that work together to reduce experience of burnout. The same is true with agile mindfulness as it has been conceptualized as a multi-dimensional construct. Using fs-QCA would help us better understand the presence (absences) of which dimension(s) of agile mindfulness lead to problem-focused coping or emotion-focused coping.

Fourth, our study relies on self-reported survey data, which may be subject to social desirability bias. Participants might have provided responses they perceived as more socially acceptable or aligned with perceived organizational norms, particularly when reporting on constructs such as mindfulness, stress, or burnout. While self-report measures are commonly used and remain a practical method for capturing individual perceptions and psychological states, they do introduce potential biases. Future research could address this limitation by incorporating multi-method approaches, such as behavioral data, peer assessments, or longitudinal designs, to triangulate responses and strengthen the robustness of the insights obtained.

7. Conclusion

With prevalent growth in use of agile methodologies among software development teams comes burnout and exhaustion across individuals in such teams, causing calls for more research to find ways to mitigate this problem. In this paper, we draw upon the TMSC and theorized agile mindfulness as a valuable resource that helps individuals use coping strategies to deal with stress due to agile methodologies. Using a cross-sectional survey of 319 IT and software development professionals, the results suggest that individuals who report high level of agile mindfulness use strategies to directly solve problems that ultimately reduce the experience of burnout. In addition, contrary to our expectation, we found that mindful individuals also use coping strategies to gain emotional stability (e.g., venting to their colleagues) although it increases their level of burnout. Our paper concludes that agile mindfulness, as a dynamic resource, can be helpful in identifying solutions to the stress they experience in such environments. In addition, organizations can put in place more support programs for such individuals so that there are more opportunities to use problem-focused coping strategies rather than emotion-focused coping strategies, resulting in lower levels of burnout.

CRediT authorship contribution statement

Hamed Jafarzadeh: Visualization, Software, Methodology, Formal analysis, Writing – original draft, Supervision, Project administration, Funding acquisition, Conceptualization, Writing – review & editing, Validation, Resources, Investigation, Data curation. **Hossein Mosafer:** Writing – original draft, Software, Investigation, Conceptualization, Writing – review & editing, Validation, Methodology, Data curation, Visualization, Project administration, Formal analysis. **Jalal Sarabadani:** Visualization, Project administration, Data curation, Writing – original draft, Software, Formal analysis, Writing – review & editing, Validation, Methodology, Conceptualization.

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

Data will be made available on request.

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