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Research Article

Workforce agility and innovative work behaviour: The moderating role of participative decision-making atmosphere among software developers

İş gücü çevikliği ve yenilikçi iş davranışı arasındaki ilişkide katılımcı karar alma atmosferinin düzenleyici rolü: Yazılım geliştiriciler üzerine bir araştırma

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Abstract

This study examines the relationship between workforce agility (WFA) and innovative work behaviour (IWB), and the moderating role of the participative decision-making atmosphere (PDMA) in this relationship, among software developers in technology-driven work settings. Workforce agility comprises three dimensions: proactivity, adaptability, and resilience, which are especially relevant in dynamic and technology-driven work settings. Drawing on self-determination theory, PDMA is considered a contextual factor that may strengthen the positive relationship between WFA and IWB by creating conditions that are more supportive of employees' autonomy, competence, and relatedness. Data were collected via a survey from 349 software developers working in Türkiye and analysed using AMOS 24 for confirmatory factor analysis, IBM SPSS Statistics 25 for descriptive and correlation analyses, and the SPSS PROCESS Macro for moderation analysis. The findings indicated that each WFA dimension was positively associated with IWB. The results further showed that these positive relationships strengthened at higher PDMA levels. Among the three WFA dimensions, PDMA's moderating effect was strongest in the relationship between resilience and IWB. This study contributes to the literature on agility and innovation by offering insight into the contextual conditions in which WFA is more strongly associated with IWB.

Keywords: Workforce Agility, Innovative Work Behaviour, Participative Decision-Making Atmosphere, Proactivity, Adaptability, Resilience

Jel Codes: M10, M12, M54

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Öz

Bu çalışma, iş gücü çevikliği ile yenilikçi iş davranışı arasındaki ilişkiyi ve bu ilişkide katılımcı karar alma atmosferinin düzenleyici rolünü, teknoloji yoğun çalışma ortamlarında faaliyet gösteren yazılım geliştiriciler bağlamında incelemektedir. İş gücü çevikliği proaktiflik, uyum sağlayabilirlik ve dayanıklılık boyutlarından oluşmakta olup, hızlı değişen ve teknoloji yoğun çalışma koşullarında özellikle önem kazanmaktadır. Öz-belirleme kuramından hareketle, katılımcı karar alma atmosferi, çalışanların özerklik, yeterlik ve ilişkili olma ihtiyaçlarını daha fazla destekleyen koşullar oluşturarak işgücü çevikliği ile yenilikçi iş davranışı arasındaki pozitif ilişkiyi güçlendirebilecek bağlamsal bir faktör olarak ele alınmıştır. Veriler, Türkiye'de çalışan 349 yazılım geliştiriciden anket yoluyla toplanmış; doğrulayıcı faktör analizi için AMOS 24, betimleyici istatistikler ve korelasyon analizleri için IBM SPSS Statistics 25 ve düzenleyici etki analizi için SPSS PROCESS Makrosu kullanılarak analiz edilmiştir. Bulgular, işgücü çevikliğinin her bir boyutunun yenilikçi iş davranışı ile pozitif yönde ilişkili olduğunu göstermiştir. Sonuçlar ayrıca bu pozitif ilişkilerin algılanan katılımcı karar alma düzeyi yükseldikçe güçlendiğini ortaya koymuştur. Üç boyut arasında, katılımcı karar alma atmosferinin dayanıklılık ile yenilikçi iş davranışı arasındaki ilişkide en güçlü düzenleyici etkiyi gösterdiği belirlenmiştir.

Anahtar Kelimeler: İşgücü Çevikliği, Yenilikçi İş Davranışı, Katılımcı Karar Alma Atmosferi, Proaktiflik, Uyum Sağlayabilirlik, Dayanıklılık

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Introduction

Digital transformation and rapid market shifts have increased the pressure on organisations to respond proactively and adapt effectively to ongoing change (AlNuaimi et al., 2022; Plekhanov et al., 2023). In this context, the role of employees becomes particularly important, as organisations increasingly depend on an agile workforce that can respond effectively to uncertainty and change (Alviani et al., 2024; Sherehiy & Karwowski, 2014). For this reason, workforce agility has become an increasingly relevant concept in contemporary organisational research (Alviani et al., 2024).

The Future of Jobs Report 2025 indicates that the skill set of 'resilience, flexibility, and agility' ranks among the top three core skills demanded in today's workforce. According to the report, 67% of employers identified this skill set as critical. The report also indicates that these capabilities are considered critical today and are expected to grow in importance by 2030 (World Economic Forum, 2025). As businesses face constant change and uncertainty, employees are increasingly expected to remain open, adaptable, and proactive. Another important finding of the report is that this skill set is considered highly important in technology-related sectors (World Economic Forum, 2025). This growing emphasis reflects the core skills required to manage today's dynamic, technology-driven work environments.

Workforce agility is conceptualised as work behaviours that enable employees to anticipate and proactively address change-related problems, adapt their skills, roles, and interactions to new conditions, and be open to change and remain resilient when coping with stress and uncertainty (Sherehiy & Karwowski, 2014). WFA has been linked to a range of positive individual and organisational outcomes. Research has linked WFA to external manufacturing flexibility (Alavi, 2016) and organisational intelligence (Sohrabi et al., 2014). WFA has also been linked to product and process innovation (Franco & Landini, 2022), innovative employee performance, organisational citizenship behaviour, job satisfaction, and well-being (Petermann & Zacher, 2022), and agile behaviours have been associated with digital technology adoption (Muduli & Choudhury, 2025). Therefore, these findings suggest that WFA may support organisational responsiveness to change and innovation capacity.

Previous studies have shown that WFA is positively related to IWB and other innovation-related outcomes (Alabood & Manakkattil, 2023; El Sayed et al., 2022; Franco & Landini, 2022). However, the role of organisational context in this relationship needs further explanation. This represents an important theoretical gap because the transformation of agile employees' proactivity, adaptability, and resilience into innovative behaviour may vary across organisational contexts. A participative work context may strengthen this relationship. From the perspective of self-determination theory (Ryan & Deci, 2000), PDMA may provide such a context by supporting employees' autonomy, competence, and relatedness needs. Since participative decision-making involves joint decision-making between managers and employees on work-related issues, it may also help employees feel that their ideas and contributions are valued (Knoop, 1995; Locke et al., 1986). Such an environment may strengthen the conditions under which employees can turn their agile behaviours into IWB. This gap is particularly relevant in software development settings, which are dynamic work environments characterised by collaboration, cooperation, and adaptation to change (Fagerholm et al., 2015), where work requires both agility and innovation (Ajgaonkar et al., 2022; Kukunda-Onyait, 2019). In addition, software development is one of the rapidly growing fields in line with Türkiye's national digitalisation plans, focusing on software-driven innovation (KPMG & Digital Türkiye Platform, 2023). Therefore, this study addresses this gap by examining whether PDMA strengthens the relationships between proactivity, adaptability, resilience, and IWB. More specifically, this study examines whether PDMA moderates the relationships between the three core dimensions of WFA and employee IWB, aiming to clarify a contextual condition under which WFA is more strongly associated with IWB.

Theoretical framework and hypothesis development

Workforce agility

An early study on agility by Yusuf et al. (1999) defined agility as the capability to respond to rapidly changing market conditions by integrating flexible resources and best practices to deliver customer-oriented products and services quickly, innovatively, and with high quality and profitability. The concept of agility initially emerged in the manufacturing sector and was later extended to broader organisational contexts through the "agile enterprise" (Goldman et al., 1994). It expanded to other business contexts, such as agile competitors (Goldman et al., 1994), agile supply chains (Christopher, 2000), and the agile workforce (Van Oyen et al., 2001).

Breu et al. (2002) provided one of the earliest conceptualisations of WFA and identified five core capabilities: intelligence, competencies, collaboration, culture, and information systems. From a behavioural perspective, Sherehiy and Karwowski (2014) defined WFA as agile behaviours or work performance and proposed proactivity, adaptivity, and resilience as its main dimensions. Proactivity refers to initiating activities that have positive effects in a changing work environment, including anticipating change-related problems and taking action to address them. Adaptivity refers to adjusting one's behaviour to new conditions and includes interpersonal and cultural flexibility, continuous learning, and the ability to work effectively across different roles, tasks, and teams. Resilience reflects the ability to function effectively under pressure, remain open to change and new ideas, tolerate uncertainty, and cope with stressful situations (Sherehiy & Karwowski, 2014).

Previous research has identified a variety of antecedents of WFA, including psychological, behavioural, and organisational factors. Storme et al. (2020) identified several psychological factors, such as job-related curiosity, job self-efficacy, learning from mistakes, anticipation and planning, active listening, risk-taking, trust in collaborators, and tolerance for ambiguity, that were positively associated with WFA. Job-related curiosity and job self-efficacy were the most important predictors of WFA among these factors. These findings suggest that employees who are motivated to learn and confident in their abilities may be more likely to exhibit workplace agility.

Organisational factors have also been identified as important predictors of WFA. Organisational learning and several dimensions of organic structure, particularly decentralised decision-making and flat structure, have been found to predict WFA (Alavi et al., 2014). Similarly, Hanu et al. (2023) reported that work-based learning practices, such as learning from peers and supervisors, reflection, and experimentation, have been positively associated with employee agility. In addition, personal development portfolios with frequent feedback have been suggested as useful human resource development tools for enhancing WFA in dynamic organisational environments (Doeze Jager-van Vliet et al., 2019).

WFA has been linked to several positive organisational outcomes. Alavi's (2016) study of Iranian SMEs suggests that an agile workforce helps firms adjust more quickly and responsively to changes in product lines and production levels, and that WFA is positively associated with external manufacturing flexibility. Similarly, Sohrabi et al. (2014) found a positive relationship between WFA and organisational intelligence among managers and employees.

Further studies have linked WFA with innovation, adaptation to technological change, and organisational performance. Franco and Landini (2022) found positive correlations between WFA and innovation in a cross-country study. Braun et al. (2017) also suggest that employee agility and resilience may help individuals deal with uncertainty more effectively and adapt to change under stressful conditions. In a systematic literature review, Muduli and Choudhury (2025) further show that different agile attitudes, abilities, and behaviours among employees can support digital technology adoption. Therefore, research suggests that agility, through proactivity, adaptability, flexibility, responsiveness, and resilience, plays an important role in managing dynamic environments and technological change.

Innovative work behaviour

Innovative work behaviour refers to a complex, self-initiated, and multidimensional form of behaviour through which employees intentionally generate, introduce, and implement new ideas to improve organisational performance, create value, strengthen competitive advantage, and support workplace sustainability (AlEssa & Durugbo, 2022). According to De Jong and Den Hartog (2010), IWB involves exploring, generating, championing, and implementing ideas.

A variety of individual and organisational factors may influence IWB. Prior research suggests that leadership styles, problem-solving approaches (Scott & Bruce, 1994), perceptions of well-being, and teamwork satisfaction (Xerri & Reid, 2018) are associated with employees' engagement in innovative activities. Similarly, organisational empowerment (Gunawan & Widodo, 2021), training and development opportunities as human resources practices (Aris et al., 2019), and management practices, including encouraging management, promoting a risk-tolerant culture, and supporting autonomy, have also been positively associated with employees' IWB (Phil-Thingvad & Klausen, 2020).

WFA appears to be an important factor associated with IWB, particularly in organisations operating in dynamic, competitive environments. El Sayed et al. (2022) found a positive relationship between WFA and IWB among staff nurses. Franco and Landini (2022) reported that WFA positively impacts both process and product innovation. Similarly, Alabood and Manakkattil (2023), based on data from private- and public-sector organisations in Saudi Arabia, found that WFA was positively related to IWB,

alongside intrinsic motivation and role congruence. These research findings suggest that IWB is influenced by various factors, including an individual's readiness, the supportiveness of the work environment, and facilitators to accessing external resources.

Participative decision-making atmosphere

Participative decision-making refers to joint decision-making between a manager and an employee, or between a manager and a group of employees (Locke et al., 1986). Knoop (1995) similarly describes participative decision-making as reaching decisions jointly with others, including subordinates, peers, and supervisors, and reports that it is positively associated with job satisfaction and organisational commitment.

Research on participative decision-making highlights its implications for both individual and organisational outcomes. Slate and Vogel's (1997) study in correctional institutions revealed that higher employee participation in decision-making was associated with reduced physical and work-related stress. Their findings further suggested that a more positive participative atmosphere was associated with reduced stress and lower turnover intentions among employees. Similarly, Scott-Ladd and Marshall (2004) reported that participative decision-making was positively related to perceptions of performance, job satisfaction, and affective commitment.

Kwon and Kim (2025) proposed a link between participative decision-making and cognitive flexibility, creativity, and employee voice. Similarly, Farzana and Charoensukmongkol (2023) found that the positive relationship between participative decision-making and IWB was stronger among faculty members with high power-distance orientation. Their findings further indicated that when highly involved in participative decision-making, high power distance-oriented faculty members' IWB may increase to a similar level as others with a low power distance orientation. These findings, therefore, suggest that PDMA may serve as a supportive variable for innovative behaviour.

The relationship between WFA and IWB

Sherehiy and Karwowski (2014) conceptualise WFA in behavioural terms, with dimensions of proactivity, adaptivity, and resilience. Previous studies suggest a positive relationship between WFA and employee IWB. El Sayed et al. (2022) noted a positive relationship between WFA and IWB. Similarly, Alabood and Manakkattil (2023) reported a positive relationship between WFA and IWB. In addition, Franco and Landini's (2022) cross-country study of nearly 18,000 private-sector establishments across 28 countries found that higher WFA was positively associated with product and process innovation. These findings provide empirical support for the expectation of a positive relationship between the behavioural dimensions of WFA and IWB. This association may be particularly relevant in software development contexts, where the work requires agility and innovation (Ajgaonkar et al., 2022; Kukunda-Onyait, 2019).

Sambamurthy et al. (2003) provide an organisational-level foundation for linking agility with innovation in dynamic environments. They argue that agility helps firms detect and seize innovation opportunities and that information technologies can support agility by enabling digital options and IT-enabled competitive actions. Building on this broader view, the present study examines agility at the employee level through WFA in a technology-driven work setting.

The dynamic capabilities approach provides a theoretical basis for explaining the relationship between WFA and IWB. Dynamic capabilities refer to a firm's ability to integrate, build, and reconfigure internal and external competencies in response to rapidly changing environments (Teece et al., 1997). This approach is especially relevant for technology-driven work settings, where employees need to recognise changes, respond to emerging problems, and support continuous renewal. Teece (2007) explains dynamic capabilities through the processes of sensing, seizing, and transforming and discusses their microfoundations. From this perspective, agile work behaviours may be understood as micro-level behavioural elements that support organisational agility and innovation in changing environments. Therefore, WFA, through proactivity, adaptability, and resilience, may support IWB by enabling employees to generate, promote, and implement new ideas in changing work environments.

Proactivity refers to taking initiative, anticipating change-related problems, and acting before these problems become more serious (Sherehiy & Karwowski, 2014). This dimension is closely related to IWB because proactive behaviour is self-starting and change-oriented. Unsworth and Parker (2003) explain that proactivity can support innovation by helping employees identify problems, develop new solutions, and persist in implementing ideas. This argument is also consistent with IWB, which encompasses exploration, generation, promotion, and implementation (De Jong & Den Hartog, 2010). In software development, proactive work behaviours may help employees notice technical or work-

related problems early, search for better solutions, and take the initiative to improve work processes. Proactivity may support IWB by encouraging initiative and early action in response to changing conditions (Sherehiy & Karwowski, 2014). Therefore, proactivity is expected to be positively associated with IWB.

H_{1a}: *Proactivity is positively associated with IWB.*

Adaptivity may help employees revise their ideas and actions in line with changing demands, continue learning, and work flexibly in dynamic environments (Sherehiy & Karwowski, 2014). This dimension is important for IWB because innovative ideas often need to be revised, improved, and implemented under changing work conditions. In the broader innovation literature, adaptability is linked to innovation because it helps organisations respond to environmental changes and create or use new opportunities (Hock-Döpgen et al., 2024). Adaptability is discussed in relation to transferring learning from one task to another when job demands change (Allworth & Hesketh, 1999) and responding quickly to modifying one's behaviour to fit a new environment (Griffin & Hesketh, 2003). At the employee level, this suggests that adaptability may help with learning new tools, adjusting to changing project needs, and improving ideas through feedback. Therefore, adaptability is expected to be positively associated with IWB.

H_{1b}: *Adaptability is positively associated with IWB.*

Resilience refers to employees' ability to remain effective under pressure, stay open to change and new ideas, tolerate uncertainty, and cope with stressful situations (Sherehiy & Karwowski, 2014). This dimension is important for IWB because innovation often involves uncertainty, difficulties, and possible setbacks. Resilience is also described as the ability to function efficiently under stress and to maintain a positive attitude toward change, new ideas, different opinions, and unexpected situations (Sherehiy & Karwowski, 2014). Resilience may be important for having positive attitudes toward new ideas, change, new technology, remaining effective under uncertainty, and coping with stress, which is closely related to IWB because developing and implementing new ideas may require employees to continue their efforts even when they face technical problems, changing requirements, or work pressure. Therefore, resilience is expected to be positively associated with IWB.

H_{1c}: *Resilience is positively associated with IWB.*

The moderator role of PDMA

From the perspective of self-determination theory (Ryan & Deci, 2000), PDMA may create conditions that support employees' basic psychological needs. Employees who perceive a participative decision-making atmosphere may feel greater autonomy. After all, they have a greater influence over issues affecting their work, greater competence because their input is recognised as valuable, and greater relatedness because of stronger feelings of inclusion and belonging. In such a context, proactivity, adaptability, and resilience may be more likely to contribute to IWB.

Prior research suggests that employee involvement influences WFA (Natapoera & Mangundjaya, 2020; Sathyanarayan & Rajan, 2023), while participative forms of leadership (De Jong & Den Hartog, 2010) and participative decision-making are positively associated with IWB (Farzana & Charoensukmongkol, 2023), cognitive flexibility, creativity, and voice behaviour (Kwon & Kim, 2025). Accordingly, PDMA may function as a contextual condition that strengthens the relationship between WFA and IWB.

PDMA may provide a supportive context in which proactive work behaviours are more likely to contribute to IWB. In a participative atmosphere, employees may have more opportunities to express ideas, share problem-solving efforts, and take initiative in improving work processes. Therefore, the following hypothesis is suggested:

H_{2a}: *PDMA moderates the relationship between proactivity and IWB.*

In a participative atmosphere, changes in work methods, revised ideas, and responses to new requirements may be more easily discussed and accepted. This may help employees use adaptability to support innovative behaviour. Therefore, the following hypothesis is proposed:

H_{2b}: *PDMA moderates the relationship between adaptability and IWB.*

PDMA may provide a supportive context in which resilient work behaviours are more likely to contribute to IWB. When participation in decision-making is encouraged, employees may be more willing to continue pursuing new ideas despite uncertainty, stress, or other difficulties. Therefore, the following hypothesis is proposed:

H_{2c}: *PDMA moderates the relationship between resilience and IWB.*

The proposed research model is presented in Figure 1. As shown, the three core dimensions of WFA, proactivity, adaptability, and resilience, are proposed to have direct relationships with IWB. PDMA is further proposed to moderate each of these relationships, such that the strengths of the proactivity-IWB, adaptability-IWB, and resilience-IWB links vary with PDMA level. In other words, higher levels of PDMA are expected to reinforce the positive relationships between each agility dimension and IWB.

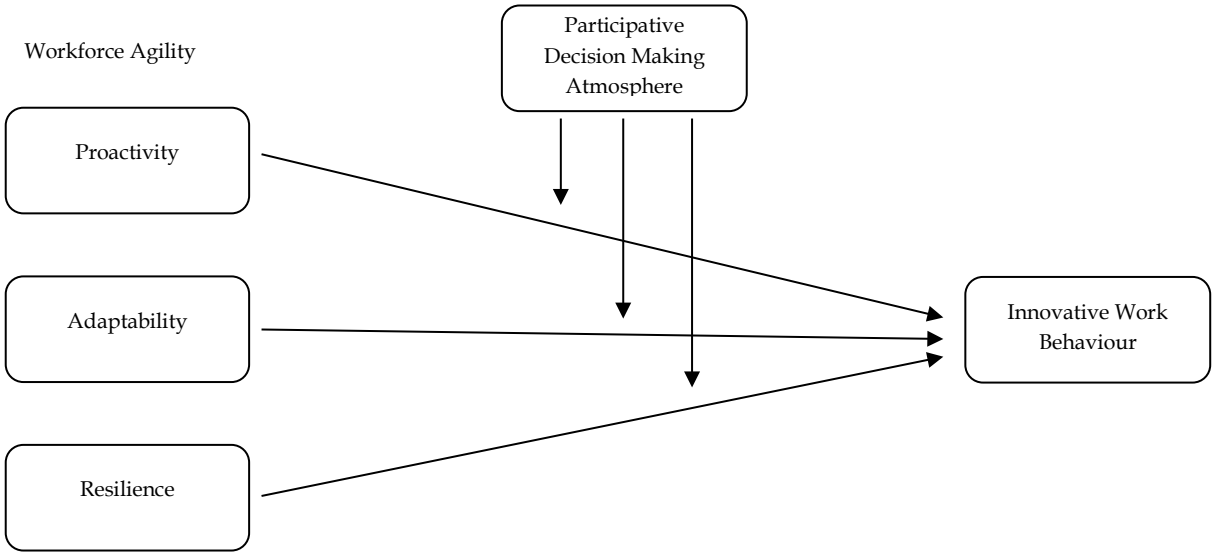

Figure 1: Proposed Research Model

Research methodology

Sample and procedures

This study's target population consisted of individuals currently working as software developers in Türkiye. Participants were recruited through criterion-based convenience sampling with chain-referral procedures. Participation was limited to individuals actively working in software development roles. Participants were reached through personal and professional networks, and they were also asked to share the survey with other eligible software developers in their organisations and networks. Participation in the study was voluntary, and informed consent was obtained from all participants. Participants were informed that no personally identifying information would be collected, and that their responses would be used only for academic purposes and kept confidential. Ethical approval was also obtained for the study.

In total, 356 questionnaires were collected. After screening, 349 usable responses were retained for the final analysis. The sample consisted of individuals employed in software development roles in different sectors. When participants were grouped by sector, the largest group was in transportation and automotive technologies (14.3%), followed by e-commerce and retail (9.5%), defense, aerospace and security (9.5%), education and educational technologies (8.6%), software and application development (8.6%), information technologies (7.2%), health and biotechnology (7.2%), finance, banking, and FinTech (6.6%), and telecommunications and communication (5.7%). The remaining participants worked in game and entertainment technologies, energy and environmental technologies, hardware and electronics, cybersecurity, network and infrastructure, cloud computing, and mobile technologies.

Software developers provide a suitable context for this study because rapid technological change, volatile market conditions, and innovation are closely related to their work. In such environments, continuous sensing, seizing, and transforming become important (Ajgaonkar et al., 2022). Software development also often involves tight deadlines and changing project conditions, which makes resilience and proactivity important in daily work (Kukunda-Onyait, 2019). The importance of adaptability in this field was also visible during the COVID-19 pandemic, when agile practices helped software developers maintain productivity despite major disruptions (Anthony Jnr, 2024). Türkiye is also a relevant context as its software development community has been growing in line with national digitalisation strategies, supported by a strong IT workforce, a focus on software-driven innovation, and a well-educated young talent pool (KPMG & Digital Türkiye Platform, 2023).

Hair et al. (2013) suggest that an adequate ratio of observations to predictors is important for reliable regression estimates. In the current study, the regression model includes 7 predictor terms and a sample

size of 349. Therefore, the present study exceeds commonly recommended observation-to-predictor thresholds.

The mean age of participants was 37.8 years, and 34% of them were women. In terms of educational background, 69.1% held a bachelor's degree, 17.2% held a master's degree, 12.2% graduated from vocational schools, 0.9% graduated from high school, and 0.6% held a doctoral degree. Participants' mean tenure in their current workplace was 6.4 years (SD = 4.46), while their mean total work tenure was 13 years (SD = 7.38).

Measures

Workforce agility, measured by three dimensions, was assessed using a 15-item scale adapted from Alavi et al. (2014), as employed in prior studies (Cai et al., 2018; Müceldili et al., 2020). Example items from the scale are "I address difficulties in my tasks before they become major problems" and "I can perform my job efficiently in difficult or stressful situations."

First, the scale was translated into Turkish by a colleague who is an English language instructor. The translated items were then reviewed by two colleagues working in the management and organisational research area, and necessary revisions were made based on their feedback. The Turkish version was then translated back into English to check for consistency by two other English-language instructors. Finally, the Turkish version of the scale was tested for clarity, and a pilot test was conducted with 20 postgraduate management students.

The participative decision-making atmosphere was measured using Slate and Vogel's (1997) Participative Decision-Making Atmosphere Questionnaire, which was adapted into Turkish by Cihangiroğlu (2009). Sample items include "I am encouraged to offer my opinions at work" and "There is an opportunity for me to have a say in the running of this institution on matters that concern me."

Innovative work behaviour was measured using the six-item scale developed by Scott and Bruce (1994). The scale was adapted into Turkish by Çalışkan et al. (2019). Sample items are "Searches out new technologies, processes, techniques, and/or product ideas" and "Generates creative ideas."

All items were rated on a five-point Likert scale.

Analysis and results

The analyses were conducted using multiple software packages. Confirmatory factor analyses were performed in AMOS 24. Descriptive statistics, correlation analyses, reliability analyses, and group difference tests were conducted in IBM SPSS Statistics 25. Direct and moderation effects were estimated using PROCESS Macro for SPSS (Hayes, 2018).

Normality was assessed using skewness and kurtosis. The skewness values ranged from -0.334 to 0.140, and the kurtosis values ranged from -1.120 to -0.032. These results suggest that the data did not show a serious deviation from normality (George & Mallery, 2010).

Internal consistency, reliability, and convergent validity

Table 1 presents the standardised factor loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) for all constructs.

As presented in Table 1, internal consistency reliability and convergent validity were evaluated using Cronbach's alpha, CR, AVE, and standardised factor loadings. The Cronbach's alpha values ranged from 0.801 to 0.902, and the CR values ranged from 0.806 to 0.902. These results indicate satisfactory internal consistency reliability (Hair et al., 2021; Nunnally & Bernstein, 1994).

The standardised factor loadings ranged from 0.404 to 0.973. All factor loadings were above 0.50, except for one item in the adaptability dimension, which had a relatively low loading (0.404). The AVE values ranged from 0.478 to 0.649. Following Fornell and Larcker (1981), an AVE value of 0.50 or higher was used as the criterion for convergent validity. The AVE values for proactivity, resilience, PDMA, and IWB were above this threshold. However, the AVE value for adaptability (0.478) was slightly below the recommended value. Therefore, the convergent validity evidence for the adaptability dimension was interpreted with caution. Since the CR value for adaptability was satisfactory (0.839), most of its factor loadings were above 0.50, and the scale was theoretically grounded in an established measurement structure, the original item set was retained.

Table 1: Standardised Factor Loadings, Reliability, and Convergent Validity of the Measures

Variables	Standardised Factor Loadings	Cronbach's α	CR	AVE
Proactivity				
Item 1	0.757	0.895	0.896	0.634
Item 2	0.720			
Item 3	0.855			
Item 4	0.859			
Item 5	0.782			
Adaptability				
Item 1	0.811	0.836	0.839	0.478
Item 2	0.709			
Item 3	0.761			
Item 4	0.820			
Item 5	0.544			
Item 6	0.404			
Resilience				
Item 1	0.659	0.801	0.806	0.512
Item 2	0.709			
Item 3	0.802			
Item 4	0.683			
Participative Decision-Making Atmosphere				
Item 1	0.738	0.902	0.902	0.649
Item 2	0.791			
Item 3	0.824			
Item 4	0.816			
Item 5	0.856			
Innovative Work Behaviour				
Item 1	0.585	0.898	0.887	0.577
Item 2	0.521			
Item 3	0.877			
Item 4	0.973			
Item 5	0.726			
Item 6	0.779			

Assessment of the measurement scales and common method bias

CFA was conducted to evaluate the factorial validity of the measurement scales. The results indicated acceptable model fit for all constructs.

For WFA (three-factor model), the fit indices were $\chi^2/df = 2.40$, CFI = 0.96, TLI = 0.95, and RMSEA = 0.063. For PDMA, the model yielded $\chi^2/df = 1.87$, CFI = 0.99, TLI = 0.99, and RMSEA = 0.050. For IWB, the fit indices were $\chi^2/df = 2.12$, CFI = 0.99, TLI = 0.99, and RMSEA = 0.057. These results provide support for the factorial validity of the measures (Hu & Bentler, 1999; Kline, 1998).

The potential for common method bias was examined using Harman's single-factor test. The results showed that the first factor alone explained 34.86% of the variance, which is below the commonly accepted threshold of 50% (Podsakoff et al., 2003). These findings suggest that common method bias may not be a serious concern in the present study.

Correlations and descriptive statistics

Correlations and descriptive statistics are presented in Table 2. As shown, all correlations among the study variables were positive and statistically significant ($p < 0.01$). The WFA dimensions, proactivity, adaptability, and resilience, were each positively associated with IWB, and PDMA was also positively related to IWB.

Discriminant validity was assessed using the Fornell–Larcker criterion. As shown in Table 2, the square root of AVE for each construct, presented on the diagonal in parentheses, was higher than its correlations with the other constructs. Therefore, the results supported discriminant validity (Fornell & Larcker, 1981).

Additional analyses using independent-samples t-tests and one-way ANOVAs revealed no statistically significant differences in WFA or IWB across demographic characteristics, including gender, educational level, and tenure.

Table 2: Means, Standard Deviations, and Correlations

Variables	M	SD	1	2	3	4	5
1. Proactivity	3.43	0.75	(0.80)				
2. Adaptability	3.53	0.64	0.54**	(0.69)			
3. Resilience	3.16	0.75	0.50**	0.63**	(0.72)		
4. PDMA	2.40	1.06	0.20**	0.27**	0.25**	(0.81)	
5. IWB	3.02	0.89	0.43**	0.48**	0.47**	0.31**	(0.76)

Note. Values in parentheses on the diagonal represent the square roots of AVE.
Correlations are presented below the diagonal.
PDMA: Participative Decision-Making Atmosphere; IWB: Innovative Work Behaviour. **p < 0.01.

Following these preliminary analyses, the hypotheses were tested using the SPSS PROCESS macro. Table 3 presents the direct and interaction effects of the WFA dimensions and PDMA on IWB.

Hypothesis testing

Table 3 presents the results of hypothesis testing, including both direct and moderated effects. As shown in the upper section of the table, all three dimensions of WFA, proactivity (b = 0.31, p < .001), adaptability (b = 0.34, p < .001), and resilience (b = 0.35, p < .001), were positively and significantly associated with IWB, supporting H_{1a}, H_{1b}, and H_{1c}.

The lower section of the table summarises the interaction effects. PDMA significantly moderated the relationship between each agility dimension and IWB. Specifically, the interaction terms for proactivity × PDMA (b = 0.12, p = 0.006, $\Delta R^2 = 0.016$), adaptability × PDMA (b = 0.11, p = 0.012, $\Delta R^2 = 0.013$), and resilience × PDMA (b = 0.18, p < 0.001, $\Delta R^2 = 0.037$) were all statistically significant, supporting H_{2a}, H_{2b}, and H_{2c}. The associated ΔR^2 values were modest, ranging from 0.013 to 0.037, and the strongest moderation effect was found for resilience. These findings suggest that the positive relationships between WFA dimensions and IWB are stronger at higher levels of PDMA. As illustrated in Figures 2, 3, and 4, the simple slopes for higher levels of PDMA are steeper, suggesting that the positive relationships between proactivity, adaptability, and resilience and IWB become stronger as PDMA increases.

Table 3: Results of Hypothesis Testing: Direct and Interaction Effects

Direct Effects	b	SE	t	p	95% CI	Hypothesis
Proactivity → IWB	0.31	0.044	7.11	<0.001	[.2247, .3966]	H_{1a} supported
Adaptability → IWB	0.34	0.046	7.32	<0.001	[.2453, .4256]	H_{1b} supported
Resilience → IWB	0.35	0.042	8.52	<0.001	[.2723, .4356]	H_{1c} supported
Interaction Effects	**b**	**SE**	**t**	**p**	**95% Bootstrap CI**	Hypothesis
Proactivity × PDMA → IWB	0.12	0.043	2.73	0.006	[.0317, .2035]	H_{2a} supported
Adaptability × PDMA → IWB	0.11	0.045	2.53	0.012	[.0125, .2157]	H_{2b} supported
Resilience × PDMA → IWB	0.18	0.042	4.27	<0.001	[.0914, .2732]	H_{2c} supported

Note. For direct effects, use 95% confidence intervals. For interaction effects, confidence intervals are 95% bootstrap-based on 5,000 bootstrap samples. PDMA: Participative Decision-Making Atmosphere; IWB: Innovative Work Behaviour.

As illustrated in Figure 2, the positive relationship between proactivity and IWB is stronger at higher levels of PDMA. When PDMA is high, increases in proactivity are associated with higher levels of IWB, whereas this relationship is weaker when PDMA is low. This is consistent with the significant interaction effect (b = 0.12, p = 0.006).

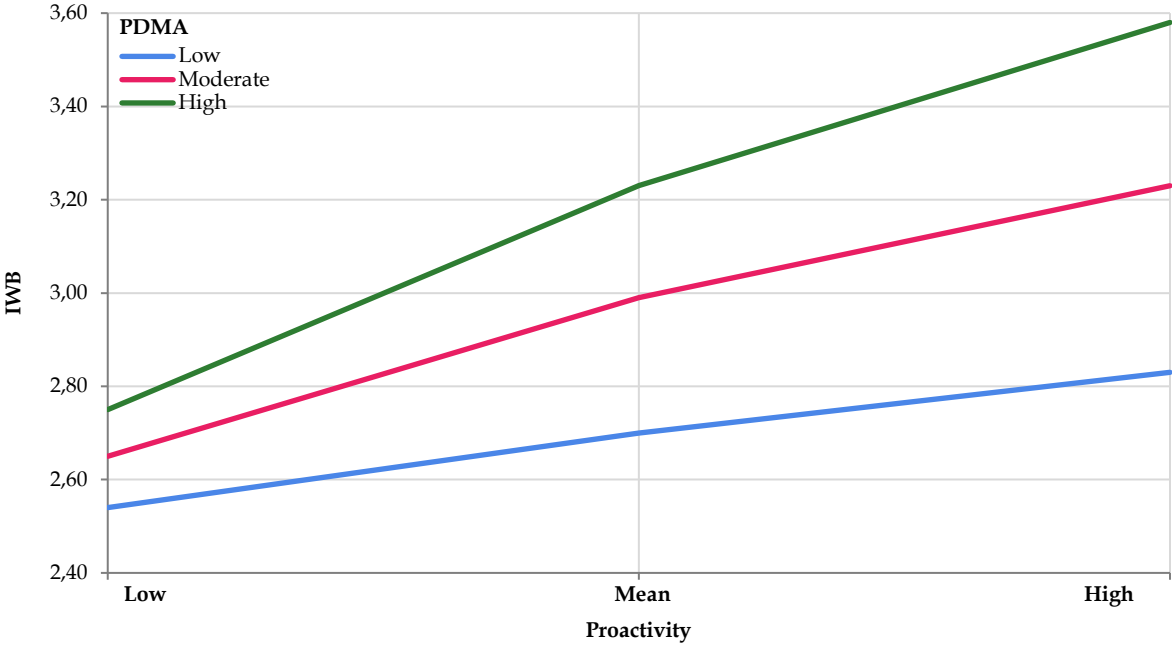

Figure 2: Interaction Effect of Proactivity and PDMA on IWB

As shown in Figure 3, the positive relationship between adaptability and IWB becomes stronger as PDMA increases. When employees perceive a more participative decision-making atmosphere, adaptability is more strongly associated with IWB. This pattern is supported by the significant interaction effect (b = 0.11, p = 0.012).

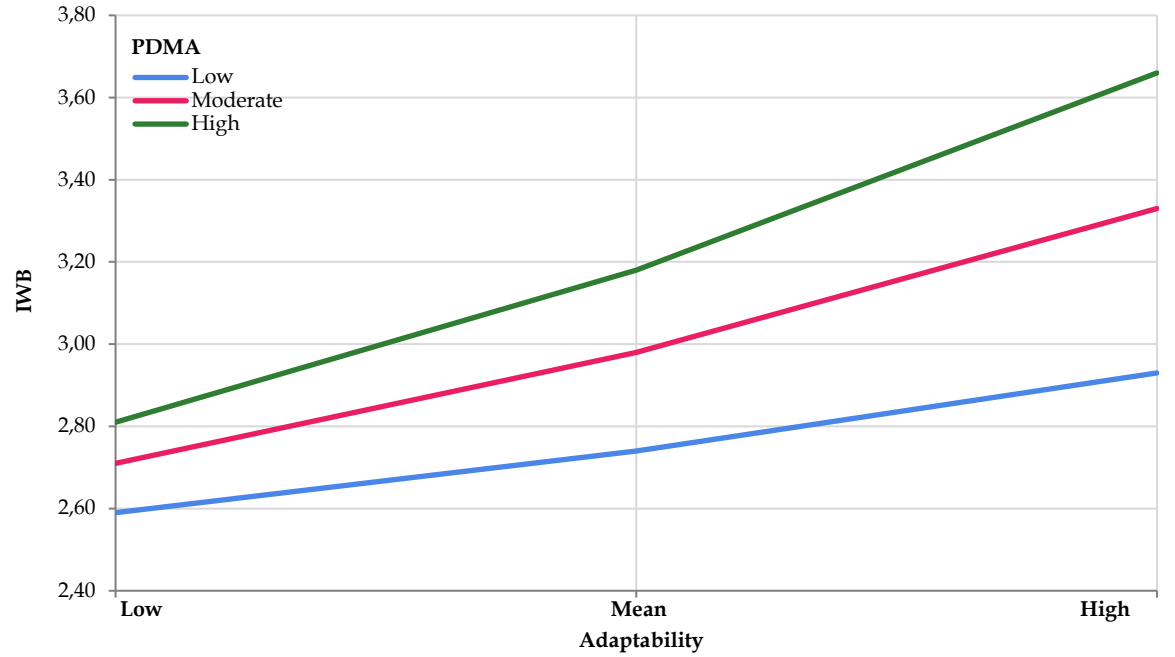

Figure 3: Interaction Effect of Adaptability and PDMA on IWB

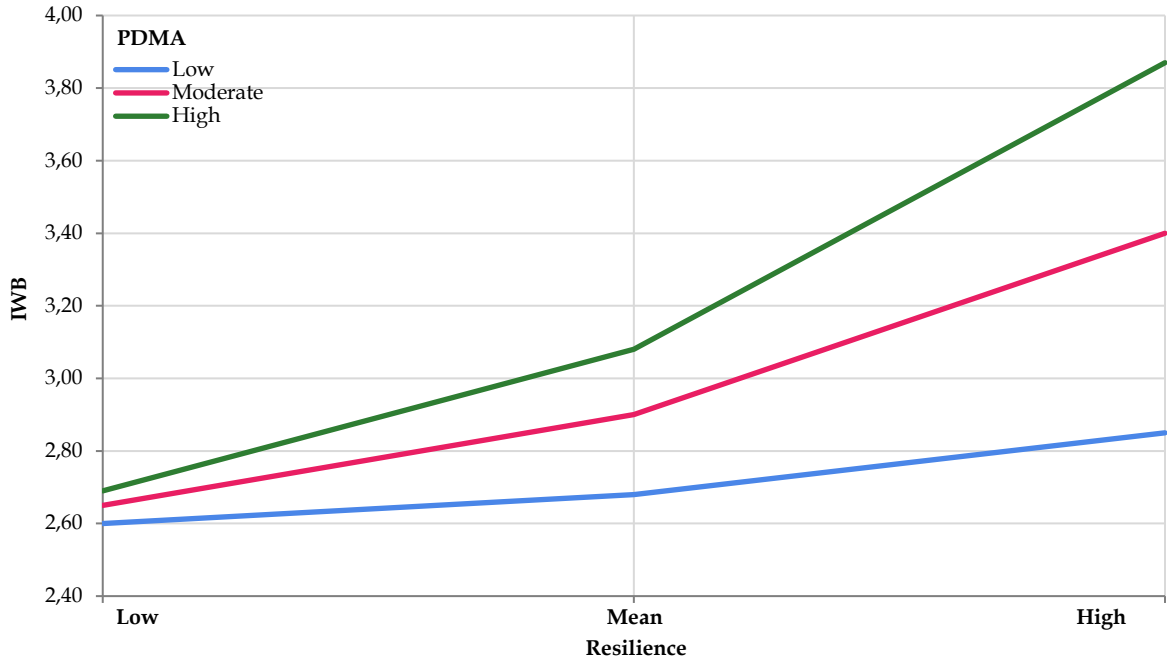

Figure 4: Interaction Effect of Resilience and PDMA on IWB

Figure 4 shows that the positive relationship between resilience and IWB is stronger at higher levels of PDMA. Among the three interaction terms, the largest interaction coefficient and ΔR^2 value were observed for the resilience × PDMA interaction ($b = 0.18$, $p < 0.001$). When PDMA is low, the positive relationship between resilience and IWB is weaker.

Conclusion and discussion

This study examined the relationships between the three behavioural dimensions of WFA, proactivity, adaptability, and resilience, and IWB, and the moderating role of a participative decision-making atmosphere between these relationships among software developers in Türkiye. The findings showed that each WFA dimension was positively associated with IWB. In addition, PDMA strengthened these positive relationships.

The present findings are consistent with prior research suggesting a positive relationship between WFA and IWB. In line with earlier evidence from nursing (El Sayed et al., 2022) and Saudi public and private sector organisations (Alabood & Manakkattil, 2023), WFA was positively associated with IWB. These findings support the view that employees who anticipate change, adapt their ways of working, and remain effective under pressure may be more likely to engage in IWB.

Beyond the positive associations between the three dimensions of WFA and IWB, the findings also indicate that PDMA moderates each WFA-IWB relationship. In other words, the positive relationships between proactivity, adaptability, resilience, and IWB become stronger when employees perceive a more participative decision-making atmosphere. These findings are consistent with prior research findings highlighting the value of participative environments for innovative and proactive employee outcomes (Farzana & Charoensukmongkol, 2023; Kwon & Kim, 2025). From the perspective of self-determination theory (Ryan & Deci, 2000), one possible interpretation is that PDMA may create conditions that are more supportive of employees' needs for autonomy, competence, and relatedness, therefore making it more likely that agile behaviours are reflected in stronger IWB.

Theoretical implications

The study's results extend the application of self-determination theory to workplace innovation by suggesting that a PDMA may function as a contextual condition that supports IWB. In organisational settings, drawing on self-determination theory (Ryan & Deci, 2000), work contexts that support employees' needs for autonomy, competence, and relatedness may strengthen intrinsic motivation. In the present study, the findings suggest that when employees perceive greater participation in decision-making, the positive relationships between WFA and IWB become stronger, highlighting the relevance of contextual factors in agility research.

The moderation findings offer a more nuanced view of how the dimensions of WFA relate to IWB. Among the three interaction terms, the coefficient for the resilience interaction was relatively larger.

One possible interpretation is that adaptability and proactivity may remain relevant to IWB even in less participative settings. At the same time, resilience may depend more strongly on contextual support in its relationship with IWB.

The present findings add to prior evidence from healthcare, private-sector, and public-sector settings (Alabood & Manakkattil, 2023; El Sayed et al., 2022; Franco & Landini, 2022) by suggesting that WFA may be positively associated with IWB across different contexts. The findings may be especially meaningful in the context of software development, because employees are frequently expected to respond to changing project conditions while sustaining IWB. Their role demands continuous sensing, seizing, and transforming in unstable markets, where rapid technological shifts and innovation pressure are common (Ajgaonkar et al., 2022). They face high resilience and proactivity requirements under tight deadlines and rapidly changing project conditions (Kukunda-Onyait, 2019). Accordingly, these findings suggest that the positive relationship between WFA and IWB may extend to different occupational settings.

The present findings add to the participative decision-making literature by showing that PDMA may be relevant for the relationship between agility and IWB. Prior research has associated participative decision-making with favourable employee outcomes, such as job satisfaction, organisational commitment, and lower thoughts of quitting (Cihangiroğlu, 2009; Scott-Ladd & Marshall, 2004; Slate & Vogel, 1997). The present findings extend this line of research by indicating that PDMA may also strengthen the positive relationships among WFA dimensions and IWB.

Practical implications

These findings highlight the importance of developing agile capabilities together with a supportive decision-making environment. Organisations may benefit from initiatives that strengthen proactivity, adaptability, and resilience, such as curiosity-driven learning programs (Müceldili et al., 2020) and digital-fluency workshops (Wei et al., 2020), while also building participative decision-making practices such as cross-functional collaboration, collaborative goal setting, and empowered teams. The findings suggest that higher levels of agility and PDMA are associated with higher IWB among software developers, indicating that a participative climate may strengthen the positive role of WFA in IWB. Practitioners may therefore benefit from aligning skill development efforts with practices that encourage employee involvement in decision-making.

Limitations and future research

This study provides additional insights into the relationship between WFA and IWB; however, its cross-sectional, self-report design may limit causal inferences. Future studies could use longitudinal designs and draw on multiple sources to further examine relationships and reduce bias. It would also be useful to test whether these moderation effects appear in other cultural settings and in industries such as manufacturing or healthcare, where innovation processes may differ. Additionally, this study examined the PDMA as a contextual factor. Future research could explore whether other contextual variables, such as motivational climates, perceived organisational support, or the quality of an organisation's digital infrastructure, also influence the relationship between WFA and IWB.

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