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Article

Effects of Public Service Motivation on R&D Project-Based Team Learning Where Psychological Safety Is a Mediator and Project Management Style Is a Moderator

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Abstract: While public service motivation (PSM) and teamwork are widely recognized as crucial drivers for effective public service delivery, researchers primarily analyze these factors independently and at a personal level. The existing literature rarely explores the interplay between PSM, the project team learning process (PTLP), and psychological safety (PS) within research and development (R&D) project teams, particularly in national R&D organizations. This study addresses this gap by proposing a theoretical model that examines the combined effect of individual motivation and team collaboration, mediated by PS, on R&D PTLP. Additionally, it investigates the moderating influence of project management (PM) styles—fully agile and partially agile—on these relationships. The proposed method utilizes partial least squares structural equation modeling (PLS-SEM) for quantitative data analysis. Our findings revealed a positive relationship between PSM, PS, and R&D PTLP, with PS acting as a significant mediator. Notably, the relationship between PSM and R&D PTLP was stronger under fully agile project management compared to partially agile settings. These findings suggest that both project teams and organizations should prioritize promoting PS and consider the moderating effects of project management styles to foster a sustainable R&D team learning process, particularly within national R&D institutions.

Keywords: public service motivation; psychological safety; project-based team learning; research team; national R&D organization; project management



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1. Introduction

The contemporary business landscape necessitates effective teamwork management for organizations to secure a competitive edge. Collaborative environments facilitate the exchange of diverse knowledge and ideas, fostering innovation and adaptability. Team learning processes (TLPs) emerge as a critical mechanism within this framework, enabling the continuous learning and development of teams. As Edmondson (2012) posits, organizations increasingly rely on teams to drive this ongoing learning, impacting overall performance. Reports by international consulting further emphasize the significance of cultivating effective learning environments for organizational success and sustainability. Leadership styles, corporate culture, and dedicated resources are identified as key drivers of TLP; however, transitioning from mere teamwork to team learning hinges on complex social dynamics at both the individual (member) and team (members, leader, and wider environment) levels. Edmondson (1999) defines team learning as a continuous process of internal and external reflection and action. This involves questioning, seeking feedback, experimenting, reflecting on results, and openly discussing errors or unexpected outcomes.

Communication lies at the heart of this definition, enabling knowledge sharing and individual learning from fellow team members. Thus, TLP reflects the iterative learning process sustained through active communication and interaction within teams.

Communication and interpersonal interaction are central to effective team learning. However, fostering positive interpersonal exchange requires specific mechanisms. Recent research identifies psychological safety (PS) as a crucial environmental factor in this process. Defined by Edmondson (1999) as a climate where individuals feel comfortable, open, and secure in expressing themselves, PS provides the foundation for strong team communication. Interestingly, studies emphasize the detrimental impact of anxiety on learning behaviors. When encountering nervousness, individuals tend to exaggerate the possibility of failure beyond reality. For instance, Zeng et al. (2020) stated that fear of sharing dissenting opinions can hinder individual role empowerment and create team discomfort. This fear often manifests as silence or passive-aggressive behavior, leading to an avoidance of potential negative feedback. These behaviors become significant roadblocks to collective learning and effective teamwork, akin to a silent cancer hindering organizational growth.

Establishing a psychologically safe environment for teams fosters open communication across diverse backgrounds. This necessitates eliminating fear-induced silence, a challenge addressed by several scholars who advocate for psychological safety (PS). PS describes a state where individuals feel comfortable expressing themselves without fear of negative consequences. By creating a secure environment, teams can lower self-protective behaviors and encourage open interaction. However, despite its benefits, excessive PS can lead to unintended negative consequences like unethical behavior. Examples include corruption, reduced dedication, and self-serving task selection. These “dark side” outcomes highlight the need for moderation in fostering PS. Additionally, PS implementation can clash with traditional Asian cultures that emphasize seniority and hierarchical structures. This conflict can be particularly acute in large, highly regulated organizations, such as government agencies. While psychological safety (PS) encourages effective teamwork, it may not sufficiently direct individual work output. Excessive PS can even demotivate employees due to a tendency to avoid challenging tasks, potentially arising from a relaxed approach to interpersonal differences within the team.

Therefore, individual motivation emerges as a crucial factor. In the public sector, particularly in developing countries like Thailand and Southeast Asia, this motivation drives domestic political issues and plays a key role in national development. Public servants face complex public expectations, making their ability to understand behavior essential for effective policy formulation. An ideal form of individual motivation is public service motivation (PSM). PSM describes an individual’s drive to benefit society without personal gain, differentiating it from other motivations. This intrinsic motivation is expected from public servants and has expanded beyond its original government context to encompass the private and volunteer sectors. PSM is generally expected to exist and influence behavior in real-world settings.

National R&D organizations operate as project-based entities, where project management (PM) styles can impact team member motivation. Heterogeneity in project teams (academic backgrounds, expertise, seniority, and personal connections) can hinder role empowerment. Team members might hesitate to express ideas due to discomfort with diverse feedback or fear of making mistakes. These factors pose obstacles to achieving PSM.

Research on the multilevel interplay between individual and team factors in the public sector remains underexplored. Notably, the relationship between public service motivation (PSM) and project team learning processes (PTLPs) within R&D project work mediated by psychological safety (PS) has received scant attention. Although numerous studies across healthcare, education, and private sector product development demonstrate a positive relationship between psychological safety and team learning process association, the nuanced dynamics in public R&D organizations, characterized by their complex goals, remain largely uninvestigated.

This paper has specific objectives as follows.

- (1) To examine the structural relationships between PSM and PTLP via PS as a mediator of the R&D project team in the national R&D organization.
- (2) To examine the differentiation of project management styles' moderator effects of structural relationships between PSM and PTLP via PS as a mediator of the R&D project team in the national R&D organization.

This study selected Thailand's National Electronics and Computer Technology Center (NECTEC) as its research target. NECTEC is a statutory government organization under the National Science and Technology Development Agency (NSTDA). It is an ideal case study for investigating the proposed framework due to its established structure and relevance to the research topic. The study anticipates a twofold impact. Theoretically, it strives to contribute to existing knowledge by proposing a comprehensive model that elucidates the relationship between public service motivation (PSM), psychological safety (PS), and project team learning processes (PTLPs). The social impact, on the other hand, lies in the potential to address performance-related issues within Thailand's national R&D organizations by enhancing learning processes.

This study proposes a novel framework to investigate the mediating role of psychological safety (PS) in the relationship between public service motivation (PSM) and project team learning processes (PTLPs), taking into account the influence of project management (PM) styles. The structure of the article is as follows. First, we introduce the research problem and objectives. Subsequently, we delve into the existing literature on PSM, PTLP, PS, and PM styles. We then provide a concise overview of the national R&D organization NECTEC, serving as the research context. Subsequently, the proposed framework and research methodology are presented. Finally, we discuss the evaluation results, followed by a comprehensive discussion, conclusion, and potential avenues for future research.

2. Literature Review

The relationship between PSM (public service motivation), PS (psychological safety), and PTLPs (project team learning processes) in R&D project teams (of national R&D organizations) is scarcely discussed among scholars. Thus, this research will propose an enhanced comprehension model of the relationship between PSM, PS, and PTLP in the context of the project management styles. The subjects' level of freedom differs depending on the style of PM. Therefore, PTLP is selected to assess the degree of freedom in this matter to obtain the output. We will mention the four vital keywords: public service motivation (PSM), project team learning process (PTLP), psychological safety (PS), and project management (PM) styles. The description of each keyword is conducted to the influence of each keyword which illustrated in the existing work. Table 1 demonstrates the comparison of the previous research works and this research.

Table 1. Comparison of previous research works and this research.

Research Work	PSM	PTLP	PS	PM
Liu and Perry (2014)	/			
Van Loon et al. (2015)	/			
Taylor et al. (2013)	/			
Word and Carpenter (2013)	/			
Potipiroon and Ford (2017)	/			
Potipiroon and Wongpreedee (2020)	/		/	
Wang and Li (2023)	/			
Lin et al. (2024)	/			
Edmondson (1999)		/	/	

Table 1. Cont.

Research Work	PSM	PTLP	PS	PM
Liu et al. (2014)			/	
Newman et al. (2017)			/	
Marder et al. (2021)			/	/
Pierce and Aguinis (2013)			/	
Rabiul et al. (2023)			/	
McElroy et al. (2024)		/	/	
Huang (2009)		/		
Marlow et al. (2018)		/		
Reagans et al. (2005)		/		
Wong (2004)		/		
Lin et al. (2022)		/		
Alami et al. (2022)		/		/
Nurmi and Koroma (2020)		/	/	
Chowdhry (2023)			/	/
Lalmi et al. (2021)				/
Barros et al. (2024)			/	/
This paper	/	/	/	/

2.1. Public Service Motivation (PSM)

The notion that public service motivation (PSM) surpasses self-interest in driving public employees remains prevalent (Houston 2000; Perry and Wise 1990). Despite various definitions (Perry and Wise 1990; Brewer and Selden 1998; Vandenabeele 2007), a common thread of service to a broader community, rather than individual gain, unites them. The concept, however, poses open questions regarding its origins and development through socialization (Wright and Pandey 2008). Understanding PSM becomes critical for public administration, as it delves into the individual's drive to benefit society through public service (Perry and Hondeghem 2008). This core concept links to the desired outcomes in public organizations, with researchers agreeing that PSM-driven individuals aim to serve the abstract notion of the public interest for collective societal benefits.

Perry (1996) identified four core dimensions of public service motivation (PSM): attraction to policymaking, public interest, compassion, and self-sacrifice. Kim ([2008] 2009) streamlined this model, reducing items from 24 to 12, while aligning with Vandenabeele's (2008) five-dimensional framework: attraction to politics, public interest, compassion, self-sacrifice, and a novel addition—democratic governance. Notably, PSM research continues to evolve with instruments adapting to organizational contexts (public vs. private). Vandenabeele and Jager (2020) developed a concise and practical PSM measure, revising earlier scales by Kim et al. (2013) and Van der Wal et al. (2008). These revisions focused solely on PSM dimensions, shifting away from cues reflecting private sector values based on individual work contexts. This emphasis reinforces the distinct nature of PSM within the public service domain.

Several topics have come about from PSM research such as job satisfaction, choice of occupation or employment sector, individual and organizational performance, organizational and job commitment, work attitudes and behavior, perceived superior trust, entrepreneurial passion, social entrepreneurship intension, public sector attraction, perceived fit with the public sector, organizational learning, change-oriented organizational citizenship behavior, and leadership (Liu and Perry 2014; Wright and Pandey 2008; Schott and Ritz 2018; Lin et al. 2024; Palma et al. 2021; Chandra et al. 2021; Carpenter et al. 2012; Li and Wang 2022; Chih and Zwikael 2015). Studies examining the relationship between PSM and turnover found it to be a negative relationship. Many studies showed the potential

negative aspects of too much PSM, e.g., stress, burnout, job dissatisfaction as well as involuntary or long-term absenteeism, negatively affecting physical well-being, and social media use for work during non-work hours (Liu and Perry 2014; Van Loon et al. 2015; Wang and Li 2023).

PSMs are examined in various fields in the public and nonprofit sectors (Taylor et al. 2013; Word and Carpenter 2013). PSM surveys were conducted in many countries such as Germany, Australia, South Korea, China, Thailand, the Netherlands, etc. (Kim 2009; Perry and Hondeghem 2008; Liu and Perry 2014; Potipiroon and Ford 2017; Potipiroon and Wongpreedee 2020; Palma et al. 2021; Wang and Li 2023; Loscher et al. 2023; Lin et al. 2024). There are a few papers that research similar topics to those in this article. For instance, Broekema et al. (2019) contribute to the understanding of public service motivation (PSM) and its influence on public leaders' post-crisis learning orientation. Our findings, based on data collected from Dutch mayors in 2015, suggest a positive association between PSM and a comprehensive approach to organizational learning following a crisis. This highlights a potential research gap at the team or project level, where future investigations could explore how PSM influences learning dynamics within smaller units. Moreover, Potipiroon and Wongpreedee (2020) studied the relationship between PSM and psychological safety in the area of local government employees, which is a study in the context of critical climates and internal whistleblowing intentions. This shows the research gap in the other sectors in Thailand that can be explored.

2.2. Psychological Safety (PS)

The concept of psychological safety has evolved over time, with key contributions from various scholars. In 1965, Schein and Bennis first introduced it as the feeling of security individuals experience during change management (Schein and Bennis 1965). Later, Kahn (1990) focused on individual perceptions of safety, defining it as the absence of fear regarding negative consequences for expressing beliefs or behaviors (Kahn 1990). This individual perspective emphasizes the role of trusting and supportive relationships in fostering psychological safety, as highlighted by Newman et al. (2017). However, perhaps the most widely cited definition comes from Edmondson (1999), who shifted the focus to group dynamics. She defines psychological safety as the shared belief within a team or group that allows members to take risks together without fear of judgment or punishment (Edmondson 1999). This definition highlights the collective aspect of psychological safety and its importance for collaborative risk-taking and innovation within teams.

Edmondson (1999) developed and validated a seven-point scale to measure team psychological safety (PS). This scale encompasses individual perceptions of safety within a team setting and captures reactions from team members towards risk-taking and honest expression. Notably, Google's Re: Work project, investigating factors associated with improved team performance, adopted Edmondson's scale to assess the PS of their teams (Google Re:Work 2024). This highlights the practical relevance of measuring PS in enhancing team effectiveness. Additionally, the Fearless Organization website offers individuals the opportunity to self-evaluate their PS using the same scale (Edmondson 2018).

Building upon Edmondson's (1999) foundational work linking psychological safety (PS) to learning and performance, researchers have delved deeper into its multidimensional impact. Studies have explored PS's relationship with various outcomes, including innovation, creativity, employee attitudes, communication, knowledge sharing, voice behavior, work engagement, and organizational commitment. They exhibited better service quality, reported lower career turnover intention/career regret, and/or were satisfied with their career (Liu et al. 2014; Newman et al. 2017; Chang and Busser 2020; Guchait et al. 2019; Huo 2021; Li et al. 2022; Rabiul et al. 2022; Wang et al. 2019; Rabiul et al. 2023). Drawing from social learning theory, social information processing theory, social identification theory, and social exchange theory, research suggests that PS fosters knowledge sharing by encouraging trust and open communication within teams (e.g., speaking up without fear of judgment) (Newman et al. 2017). This in turn facilitates

individual and team-level learning behaviors, ultimately indirectly influencing employee performance (Baer and Frese 2003). McElroy et al. (2024) identified three key themes related to psychological safety and hierarchy in the operating room debriefing process: (1) “commitment to learning”, (2) “it is a safe space”, and (3) “natural leader”. These themes suggest that debriefings can foster a culture of learning and quality improvement among frontline workers. Furthermore, the findings support the notion that debriefings can serve as a vehicle for individual and team learning, potentially contributing to broader organizational change. Notably, the study also highlights the importance of mitigating hierarchical influences and power structures to facilitate such positive organizational transformation. Furthermore, PS extends its influence beyond individuals and teams, impacting organizational performance. Baer and Frese (2003) found a strong positive correlation between employees’ collective perception of PS and organizational metrics like return on assets and goal achievement. PS also enhances employee attitudes, fostering organizational commitment, work engagement, and positive teamwork perceptions. The study of the development of a competency framework defining effective surgical educators proposed that fostering PS was the first competency from five competencies and sixteen behaviors, Sharma et al. (2024). PS has a strong relation with the agile technique in team learning processes; psychological safety can be increased through peer and tutor support, the use of smiley emojis, and initiatives to reduce disruptive behaviors (Marder et al. 2021). Consistent with the study of Barros et al. (2024), they found psychological safety is a significant indirect success factor for agile software development projects. The direct success factor is team capabilities and customer involvement. This fosters an environment where employees are more receptive to new technologies, continuous learning, and adapting to challenges.

While psychological safety (PS) boasts numerous benefits for teams, research suggests a potential “too-much-of-a-good-thing” effect (Pierce and Aguinis 2013). In excessively high-PS environments, team dynamics can shift, leading to negative consequences. Pierce and Aguinis (2013) found that overly high PS may increase the likelihood of unethical behavior, as team members prioritize personal interests over group goals and engage in collusion. While limited research currently exists on the full spectrum of PS’s potential downsides, Newman et al. (2017) cautiously acknowledge the possibility of such negative outcomes. Further investigation into the potential “dark side” of PS could offer valuable insights for practitioners in balancing its advantages with potential risks.

2.3. Project Team Learning Process (PTLP)

As more responsibility and information falls on teams’ shoulders, it is crucial to understand the influence of team learning behaviors on team effectiveness. Team learning behaviors are essential for team performance, no matter the situation. Most product and technology development is moving towards team-based structures, since teams are believed to increase individual commitment and performance (Ramesh and Tiwana 1999). Vicarious learning may be an efficient supplement to direct experience, allowing people to profit from lessons gained from a wide variety of others’ experiences in a short amount of time. It is beneficial in the case of vicariously shared failure stories due to the increased emotional impact and the higher value of the knowledge generated by failure compared to success (Bledow et al. 2017; Sitkin 1992). Organizational environment is progressively more turbulent, dynamic, and complex than ever, creating learning demands beyond the capability of an individual (Tannenbaum et al. 2012).

Team learning has been conceptualized in a number of ways in the research literature. For instance, Edmondson et al. (2007) views team learning as an “encompassing rubric”, or a useful abstraction of an organizational phenomenon, and defined team learning as a process in which a team takes action, obtains and reflects on feedback, and makes changes to adapt or improve. Another perspective of team learning is as a dynamic process in which the learning process, the conditions that support them, and team behaviors change as the team changes (Sessa and London 2007). Team learning is a critical process in developing

new products and services quickly and effectively (Edmondson and Nembhard 2009; Lynn et al. 1999). Team learning refers to a continuous process of reflection and action directed toward obtaining and processing information to detect, understand, and adapt to changes in an environment, and to improve the performance of a team (Edmondson 1999). Team learning, characterized as a cyclical process of reflection and adaptation fueled by psychological safety (Knapp 2010), fosters knowledge creation through the transformation of shared group experiences. Team learning processes are measured using learning behaviors in work teams, experiential learning in teams, team learning and metacognition, and team learning beliefs and behaviors (Van den Bossche et al. 2006; Edmondson 1999; Kayes et al. 2005; McCarthy and Garavan 2008).

Previous studies have investigated the role of a variety of factors such as infrastructure capabilities, user involvement, reporting quality, project risk, leadership styles, and problem-solving competency in information technology (IT) project performance (Xu et al. 2010; Doll and Deng 2011; Thompson et al. 2007; Wallace et al. 2004; Thite 2000; Aladwani 2002; Li et al. 2011). In technology R&D teams, trust fosters communication and an awareness of individual expertise (Huang 2009). This clarity enables efficient knowledge encoding and retrieval, ultimately facilitating knowledge sharing within the team. Kirkman et al. (2004) found no direct link between team leader–member racial similarity and team effectiveness, and so research on how racial diversity impacts team dynamics remains crucial. Communication allows for resource pooling in planning, which improves team performance. Furthermore, communication quality will have a bigger impact than frequency, and certain communication kinds (face-to-face, familiar teams) may exhibit stronger performance correlations (Marlow et al. 2018).

Several scholars found psychological safety is a key element for grooming the team learning process under various contexts. For instance, team psychological safety mediates the relationship between team leader coaching and context support and the result of team learning behaviors, linking it to human resource development (HRD) and adult education theory and practice (Knapp 2010). Previous research has demonstrated that individual experience (Reagans et al. 2005), team psychological safety (Edmondson 1999), and group cohesiveness (Wong 2004) have a major impact on a team's learning behavior (Kostopoulos et al. 2011). Psychological safety and team learning are important processes for understanding the enhancement of change-oriented leaders who help healthcare teams perform better. There is a favorable and strong association between change-oriented leadership, psychological safety, team learning, and team performance. Change-oriented leadership, which focuses on key innovations, improvement, and adaptability to external changes, encourages team members to learn (Lin et al. 2022). In nursing education, team learning and psychological safety are fundamental to developing professional nursing competencies. Most multinational corporations (MNCs) nowadays mandate English as a common company language, i.e., lingua franca, to facilitate international collaboration between employees who speak different native languages (Neeley 2017). The psychologically safe language climate made working in English feel easy and comfortable for the non-native speakers when they work in MNCs (Nurmi and Koroma 2020). In agile software development, agile practitioners interpret technical excellence as a mindset that emphasizes continuous attention to a sustainable code, learning, and teamwork. While our findings show that a mindset of continuous attention to a sustainable code is an important pillar for technical excellence in agile teams, they point to important roles of mindsets for continuous attention to learning and to the team (Alami et al. 2022).

2.4. Project Management (PM)

Organizations have become more project-based throughout the years in order to achieve their business objectives more economically (Blomquist and Müller 2006). Research has suggested combining elements from the traditional and agile approach as a solution to this matter, meaning that they apply the agile method to a limited degree (Abrahamsson et al. 2009). The literature on traditional and agile project management approaches will

be presented to distinguish the differences between the approaches. There is academic research on project management; it is primarily a form of structuring work processes. Project management is simultaneously an area of research, an application, a type of practice, and a method of conducting work (Palatz 2012).

Project management type (PM) refers to the way in which teamwork is managed. Agile PM (APM) is commonly used in software development projects, and waterfall PM (WPM) is an easy type to use and understand and is commonly used to manage projects in the government sector. WPM is the traditional approach to project management and is defined by simplicity, predictability, and linearity, where boundaries are well-defined in order to make planning easier (Špundak 2014). However, the “one size fits all” method is difficult to apply in more complex project management situations, as different situations require different solutions (Fernandez and Fernandez 2008). As the management method attempts to avoid changes, it can be difficult to implement in more complex and dynamic environments.

APM is different from WPM. The APM approach has been prevalent in recent years as project environments have become more dynamic. These project environments require more flexibility and the ability to adapt to changes, which is prominent in agile project management methods. For the agile method to work, a significant degree of interaction within the project team is needed, as well as active cooperation with customers and main stakeholders (Conforto et al. 2014; Andrei et al. 2019). This way, customers and stakeholders are more involved in the project process and are able to suggest changes along the way. Due to unpredictability and rapid changes, it can be challenging to specify the final solution of the project in advance (Fernandez and Fernandez 2008). Projects with innovative goals require team autonomy and agile communication practices that are sufficient for the agile teams to be empowered (Malik et al. 2021).

There have been several research studies conducted on PM in the past. Because large firms frequently divide their activities into minor to mega project levels. The classic project style, often known as WPM, is commonly referenced, whereas the current popular approach is APM. The preceding paragraph explained the distinctions between WPM and APM. Thus, this part will address PM usage in prior work passes via various perspectives. For instance, in the industry sector, agile methods are mainly used in product development, project management, and process development, whereas the usage in assembly planning and factory planning is less common (Burggräf et al. 2020). In ‘Team science and building a team’, it was noted that modern progress in translational medicine requires highly integrated teams working together to achieve scientific goals. Understanding team formation, evolution, project management, and psychological safety can maximize innovation and scientific success (Chowdhry 2023). Innovation resilience behaviors in innovation project teams are positively related to project success. Moreover, innovation resilience behaviors become more critical as adversity increases (Fey and Kock 2022). In large software projects, agile methodologies aimed to reduce project failure risk by focusing on human-related factors like team capability and customer involvement, and it was found that psychological safety is an essential condition involved in that achievement (Barros et al. 2024). However, organizational culture plays a crucial role when implementing agile management methods. This statement is supported by several authors. At the individual level, project team members should have sufficient competence to understand and outline potential risks and changes in the project. They should be able to affect the outcome of the project, organizational goals, and value provided to customers. This may affect team learning processes positively, which is recommended in future works (Conforto et al. 2014).

Moreover, many studies have modified APM formats to be more diverse and suitable for different contexts or situations. For example, Lalmi et al. (2021) report that agile project management can be suitable for the design phase of construction projects. Failure can occur due to cost overruns, schedule overruns, or unreasonable growth in project content. A hybrid project management model based on lean, agile, and traditional approaches

can increase project success by reducing costs, shortening schedules, optimizing results, eliminating waste, and increasing satisfaction. The organization should be flexible and adaptive to agile methods, willing to invest time and resources in successfully implementing agile methods or a more suitable hybrid method, if preferred. With the willingness to embrace change and work together as a dynamic team, the right skills and knowledge of the project stakeholders, including the customers, will deliver greater success rates (Sithambaram et al. 2021). Combining agile project management and stage-gate models in a technology-driven project has a positive impact on the project and product development performance, making it a potential solution for managing innovation projects in high technology-based companies (Conforto and Amaral 2016).

However, some papers apply PM to the public sector; the study from Muhammad Zada of the Iqra National University (2023) explores the impact of public leadership on project management effectiveness, particularly in the public sector. The results indicate that public leadership has a positive effect on goal clarity and project management effectiveness. The study also finds that top management support plays a significant role in mediating the relationship between public leadership and project management effectiveness. Overall, public leadership is crucial in ensuring the success of projects, especially in the public sector, where there are multiple stakeholders, limited resources, and complex regulatory requirements.

The current findings imply a potential need for tailoring project management (PM) types to specific project characteristics or contexts. Further research is warranted to explore this notion in greater depth. It is plausible that various contextual factors within the research setting, beyond the chosen PM type, might have influenced the observed outcomes. Future studies could benefit from directly investigating the interaction between PM type and relevant contextual variables for a more nuanced understanding of their combined effect on project outcomes.

This knowledge gap warrants further research. The research question is as follows: how does public service motivation (PSM) influence project-based team learning processes (PTLPs) through the lens of psychological safety (PS) and project management types (PM) in national R&D organizations?

3. Methodology

This study introduces a new paradigm that investigates the relationship between essential elements that affect project results in research and development (R&D) teams within R&D organizations in Thailand, addressing a previously reported gap in research. This study addresses a gap in research by introducing a novel paradigm examining the intricate relationships between public service motivation (PSM), psychological safety (PS), project team learning processes (PTLPs), and project management styles (PM) within Thai R&D teams. Figure 1 illustrates the framework's proposition of a connection between public service motivation (PSM), psychological safety (PS), and the project team learning process (PTLP) with the following five hypotheses.

Hypothesis 1 (H1). *PSM positively affects PS.*

Hypothesis 2 (H2). *PSM positively affects PTLP.*

Hypothesis 3 (H3). *PS positively affects PTLP.*

Hypothesis 4 (H4). *PS is the mediator of the relationship between PSM and PTLP.*

Hypothesis 5 (H5). *The difference between F-APM and P-APM affects the relationship between PSM and PTLP with PS as a mediator.*

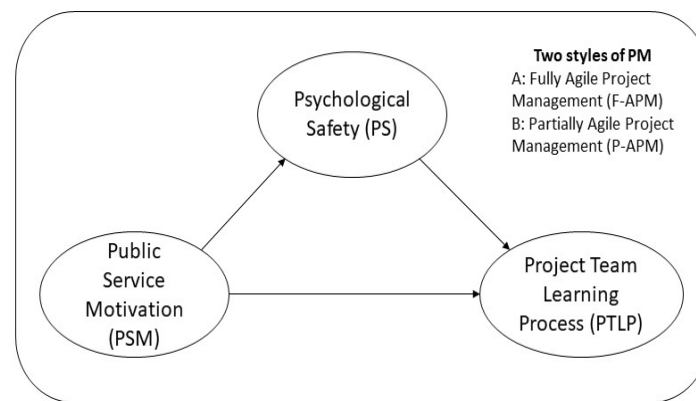


Figure 1. The research framework.

Our framework proposes a complex interplay where PSM is hypothesized to positively influence both PS (H1) and PTLP (H2), with PS potentially mediating the relationship between PSM and PTLP (H4). This builds upon existing research, demonstrating PSM's positive influence on learning orientation (Broekema et al. 2019) and psychological safety in local government settings (Potipiroon and Wongpreedee 2020). We extend this research to the under-researched context of Thai national R&D institutes, suggesting similar effects in smaller teams or project levels. H3 is further supported by Edmondson (1999), who found that psychological safety fosters team learning and performance and aligns with research by McElroy et al. (2024), suggesting its compatibility with agile methodologies. Moreover, we posit a moderating effect of PM style (H5), with the influence of PSM on PTLP potentially mediated by PS to a greater extent in fully agile PM (F-APM) compared to partially agile PM (P-APM). While existing research suggests the effectiveness of agile practices for fostering psychological safety and team learning (Chowdhry 2023; Barros et al. 2024), notably, research by Sharma et al. (2024) highlights the potential benefits of F-APM for fostering psychological safety compared to more traditional approaches. The limited exploration of partially agile approaches necessitates further investigation.

Additionally, PS is examined under the mediator perspective. Project management style was categorized into two distinct styles: fully agile and partially agile, reflecting the inherent characteristics of different project management approaches. PSM represents the intrinsic motivation of individuals to contribute to the betterment of society, which might enhance commitment and creative thinking within research and development teams. PS denotes the degree of trust and willingness to take risks within the team environment, which is essential for achieving the highest level of learning and cooperation. PTLP refers to the team's dynamics and techniques for acquiring and using collective knowledge. Project management styles include the methodologies project teams use to assign tasks, make decisions, and communicate throughout the project. The concept indicates that these variables engage in dynamic interactions, exerting mutual influence and eventually affecting the project. R&D project-base team was selected for the scope of the study.

Data for this study were collected via an online survey administered in 2021 to research and development (R&D) staff at the National Electronic and Computer Technology Center (NECTEC) within the National Science and Technology Development Agency of Thailand. NECTEC's R&D unit comprises skilled professionals responsible for conducting, supporting, and promoting advancements in electronics and computer technologies. This mission is achieved through established industrial clusters and programs aligning with NECTEC's overarching goal to build a robust technological foundation for Thailand. Examples of key technology areas and target outputs include strategic big data, precision farming, smart factory initiatives, AI services, and quantum computing. Notably, R&D projects at NECTEC utilize various project management (PM) styles, with team leaders empowered to select the most suitable approach for their teams. With a total workforce

of 582, NECTEC boasts a highly qualified R&D department, exceeding 70% of its staff. All R&D personnel hold bachelor’s degrees or higher, reflecting the demanding nature of advanced technological research, which necessitates mastery of both hard and soft skills. However, the diverse academic backgrounds and expertise of team members can sometimes pose challenges to their collaborative efforts.

The survey instrument was approved by the NECTEC director for inclusion in internal manpower development initiatives. However, participants were informed that their participation was voluntary, their responses were confidential, and they could refuse questions or withdraw at any time. While 165 responses were initially collected, data-cleaning procedures resulted in a final sample size of 160, representing 45.67% of the target population. The demographics of the sample were representative of the study population in terms of their project management styles (fully agile and partially agile) as shown in Table 2. However, further details about the participant characteristics are not presented due to privacy policy considerations and to protect the anonymity of voluntary participants.

Table 2. Demographic characteristics of the respondents.

Demographics	Group	Frequency	Percentage (%)
Total of respondents		160	45.67 of population
Project management style (PM)	Fully agile project management (F-APM)	81	50.63
	Partially agile project management (P-APM)	79	49.38

3.1. Characteristics of Respondents

Before using the partial least square structural equation model to test the hypotheses, we first described the demographic characteristics of the respondents according to the results in Table 2.

3.2. Questionnaires

This study measured several key variables: public service motivation (PSM), psychological safety (PS), and project team learning process (PTLP). PSM was assessed using a modified version of the seven items developed by [Vandenabeele \(2014\)](#) and [Vandenabeele and Jager \(2020\)](#) that based on [Perry’s \(1996\)](#). These concise seven items aim to enhance participant focus and questionnaire completion rates, potentially leading to improved data quality compared to employing longer items. For PS, we selected a combination of [Edmondson’s \(1999\)](#) PS item and Aristotle’s Google project indicator to conduct the PS questionnaire. For PTLP, we applied the six items of team learning behaviors of [Edmondson \(1999\)](#) to conduct the survey. Variables were measured on a five-point scale: 1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, and 5: strongly agree. The suffix “R” of certain PS constructs in Table 3 signifies the reverse scored item when we analyzed the data. The reflective indicator variable was measured with the PS and PTLP parameters and was represented in the latent variables of the model.

Table 3. The list of items for measurement under each construct.

Construct	Items of Measurement	
Public service motivation (PSM)	1.	You are very motivated to contribute your work to society.
	2.	Being able to contribute your work to society is very motivating.
	3.	Defending the public interest is very important to you.
	4.	You voluntary and unselfishly contribute to your team or organization.
	5.	Serving the public interest is an important drive in your daily life (at work or daily life).
	6.	To me, before anything, a good researcher should think of society.
	7.	To me, helping people who are in trouble by research is very important.

Table 3. Cont.

Construct	Items of Measurement
Project team learning process (PTLP)	1. Member tends to handle conflicts and differences of opinion privately or off-line, rather than addressing them directly as a group. (R)
	2. This team frequently obtains new information that leads us to make important changes in our plans or work processes.
	3. Members of this team often raise concerns about team plans or decisions.
	4. We try to discover assumptions or basic beliefs about issues under discussion.
	5. Members put effort into the project by going out and getting all the information it possibly can from a lot of different sources.
	6. We invite people from outside the team to present information or to have discussions with us.
Psychological safety (PS)	1. If you make a mistake on this team, it is often held against you. (R)
	2. Members of this team are able to bring up problems and tough issues.
	3. People on this team sometimes reject others having different opinions. (R)
	4. It is safe to take a risk in this team.
	5. It is difficult to ask other members of this team for help. (R)
	6. No one on this team would deliberately act in a way that undermines my efforts.
	7. Through working with members of this team, my unique skills and talents are valued and utilized.

3.3. Analysis Technique

The suitability of the partial least squares structural equation modeling (PLS-SEM) technique for this study is grounded in several key considerations. First, PLS-SEM exhibits robustness to non-normal data distributions, making it particularly advantageous when data deviate from normality, as is a potential concern in this research. Second, PLS-SEM is well-suited for small sample sizes, mitigating potential limitations arising from restricted data availability. Finally, PLS-SEM excels in exploratory research contexts aimed at developing new theoretical insights. Its ability to handle complex models with minimal distributional assumptions makes it ideal for elucidating intricate relationships and fostering greater understanding within this study. These combined strengths render PLS-SEM a compelling choice for analyzing the data in this investigation.

This study employed partial least squares structural equation modeling (PLS-SEM) to analyze the dataset. The analysis followed a three-step approach. First, the PLS algorithm was utilized to estimate the model's constructs and assess their measurement properties. Second, a bootstrapping procedure was conducted to evaluate the statistical significance of both the structural model paths and any potential mediating effects. Finally, multigroup analysis (MGA) was employed to explore the influence of moderating variables. MGA is a non-parametric significance test for group differences, leveraging the bootstrapping results obtained from the PLS-SEM analysis (Sarstedt et al. 2011).

4. Results of Hypotheses Validation

4.1. Structural Relationship between PSM and R&D PTLP with PS as a Mediator

The first stage of the analysis addresses the measurement model assessment for public service motivation (PSM), psychological safety (PS), and research and development project team learning process (R&D PTLP), constructed under the partial least squares structural equation modeling (PLS-SEM) framework. Two established indicators, Cronbach's alpha (CA) and composite reliability (CR), were employed to evaluate internal consistency reliability. A requirement of 0.6 to 0.9 for CA and CR (Bagozzi and Yi 1988) serve as the indicators for satisfactory reliability.

Furthermore, two indices were utilized to assess construct validity: outer loadings and average variance extracted (AVE). Outer loadings exceeding 0.4 indicate acceptable individual item reliability. Convergent validity is established when AVE surpasses 0.5, as per Bagozzi and Yi (1988) and Hair et al. (2013), signifying distinctness between constructs shown in Table 4.

Table 4. The results of reliability and validity of PSM, PS, and R&D PTLP constructs.

Construct	Internal Consistency Reliability		Discriminant Validity	Indicator Validity
	Cronbach's alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)	Outer Loading
Indicators	0.6–0.9	0.6–0.9	>0.5	>0.4
Public service motivation (PSM)	0.862	0.893	0.545	PSM 1 (0.825) PSM 2 (0.817) PSM 3 (0.704) PSM 4 (0.732) PSM 5 (0.702) PSM 6 (0.705) PSM 7 (0.669)
Psychological safety (PS)	0.754	0.836	0.508	PS 2 (0.693) PS 4 (0.596) PS 5R * (0.775) PS 6 (0.657) PS 7 (0.820)
R&D project team learning process (PTLP)	0.755	0.835	0.504	PTLP 1R * (0.684) PTLP 2 (0.749) PTLP 3 (0.701) PTLP 4 (0.639) PTLP 5 (0.761)
Meaning	Acceptable	Acceptable	Acceptable	Acceptable

* The suffix “R” of certain PS constructs signifies the reverse scored.

The constructs achieved satisfactory levels of reliability and validity. Composite reliability (CA) exceeded 0.75 and Cronbach's alpha (CR) exceeded 0.83 for all constructs (public service motivation (PSM), psychological safety (PS), and R&D project team learning process (PTLP)), exceeding recommended thresholds. Average variance extracted (AVE) values were above 0.50 for all constructs, demonstrating adequate convergent validity. Finally, all item loadings exceeded 0.4, confirming individual item reliability.

Building upon the prior stage, this study examined the structural relationships between PSM, PS, and PTLP within research and development (R&D) project teams in a national R&D organization. These are the results of validating our four hypotheses; H1, H2, H3, H4.

The results indicate path analysis revealed a positive and significant association between PSM and PS ($\beta = 0.405, p = 0.000$), with PS further exerting a significant positive influence on PTLP ($\beta = 0.480, p = 0.000$). Additionally, a weaker but significant direct effect of PSM on PTLP was observed ($\beta = 0.210, p = 0.024$). These findings were confirmed through bootstrapping analysis, with all t-statistics exceeding the critical value of 1.96 and p-values reaching significance at the 0.05 level. Overall, the results demonstrate a positive relationship between PSM, PS, and R&D PTLP, suggesting that higher levels of public service motivation are associated with increased personal satisfaction and greater perceived task leadership participation within R&D teams. Moreover, the effect size of this model is given by the value of F square. Cohen (1988) defined F square as less than 0.2 (no measurable effect), 0.02–0.15 (small effect size), 0.15–0.35 (medium effect size), and more than 0.35 (large effect size). The model demonstrates moderate to large effect sizes for the individual paths: PSM to PS ($f^2 = 0.196$), PS to PTLP ($f^2 = 0.299$), and the direct effect of PSM on PTLP ($f^2 = 0.057$). This suggests that PS plays a significant role in explaining both PTLP and the impact of PSM on PTLP. These are shown in Table 5.

Table 5. The results of the structural model examination.

Relationship	Path Coefficients (β)	<i>t</i> -Statistics	<i>p</i> -Value	F-Square (f^2)	Meaning
PSM to PS	0.405	6.151	0.000	0.196	Acceptable
PS to PTLP	0.480	7.639	0.000	0.299	Acceptable
PSM to PTLP	0.210	2.262	0.024	0.057	Acceptable

Finally, the mediation analysis confirmed the partial mediating role of PS in the relationship between PSM and R&D PTLP. The specific indirect effect of PSM on PTLP through PS was significant and positive ($\beta = 0.194$, $t = 4.717$, $p < 0.000$). This indicates that while PS partially mediates the PSM-PTLP relationship, a direct effect also exists, as shown in Table 6.

Table 6. The results of the mediator examination of the structural model.

Relationship	Specific Indirect Effects	<i>t</i> -Statistics	<i>p</i> -Value	Meaning
PSM to PS to PTLP	0.194	4.717	0.000	PS as a mediator, acceptable

The analysis revealed a significant and positive relationship between public service motivation (PSM) and R&D project team learning processes (PTLPs) mediated by psychological safety (PS). This indicates that PS partially mediates the influence of PSM on PTLP. Therefore, PSM emerges as a crucial construct impacting both PS and PTLP within R&D project teams.

4.2. Moderator Effect of PM on Structural Relationship between PSM and R&D PTLP with PS as a Mediator

Having established the structural relationships between R&D project team learning process (PTLP), public service motivation (PSM), and psychological safety (PS) with PS acting as a mediator, a key question remains: how do the project management styles moderate these relationships? The results of validating of the H5 show the following:

Multi-group analysis (MGA) within the partial least squares structural equation modeling (PLS-SEM) framework was employed to answer this question. The findings are presented in Table 7.

Table 7. The results of PLS-MGA analysis of different the PM groups.

Relationship	Path Coefficients Diff (F-APM)–(P-APM)	<i>p</i> -Value	Meaning at Significant Level 0.05
PSM to PS	0.049	0.696	Not different
PS to PTLP	0.165	0.189	Not different
PSM to PTLP	−0.024	0.891	Not different

The path coefficient analysis revealed nuanced interactions between project management type and public service motivation (PSM) on project team learning process (PTLP) and psychological safety (PS). For PS to PTLP and PSM to PS, the path coefficient indicated a stronger positive relationship in the model with fully agile project management (F-APM) compared to partially agile project management (P-APM). However, for PSM to PTLP, the model showed a weaker positive relationship with F-APM compared to P-APM. Notably, the significance test (p -value > 0.05) for the interaction between project management type and PSM on PTLP mediated by PS suggests this difference is not statistically significant.

5. Discussion and Managerial Insight

In this research, we question the belief that PSM universally results in R&D project team learning. When considering this, we took into account the moderating effects of intrinsic motivation and the learning process of the R&D project team. Thus far, there has been little focus on comprehending the possible limitations that might clarify the differences in the connection between PSM and team learning. The noteworthy interconnections observed in our research provide essential additions to the literature on PSM. Studies have consistently shown that people who possess a high level of public service motivation (PSM) are more inclined to exhibit dedication and loyalty towards their public sector organizations. This commitment is primarily driven by the perceived alignment between the organizations' attributes and their own personal values and beliefs.

Our research findings reveal a more nuanced understanding of the relationship between public service motivation (PSM) and the project team learning process (PTLP) compared to initial assumptions. Notably, the findings show that psychological safety (PS) acts as a crucial mediating variable that strengthens the association between PSM and PTLP. While the direct effect of PSM on PTLP is positive and statistically significant, the indirect effect mediated by PS is demonstrably stronger. These align with the concept that a psychologically safe climate can facilitate the fulfillment of employees' altruistic needs. Within this climate, employees feel empowered to voice their ideas and concerns, openly discuss problems, and contribute their best solutions (Edmondson 1999; Baer and Frese 2003). This sense of security is likely fostered by the characteristics of PS, which promote open communication and knowledge sharing through trust-building mechanisms (Liu et al. 2014; Newman et al. 2017). They likely create an environment that indirectly influences employee performance, potentially by fostering collaboration, innovation, and knowledge transfer (Baer and Frese 2003).

This study contributes to the existing scholars on public service motivation (PSM), psychological safety (PS), and project team learning process (PTLP). We expand the understanding of PSM's influence by demonstrating its role in facilitating PTLP, a relationship not previously explored in depth. Our findings extend prior research on PSM, which has primarily focused on its connection to factors like job satisfaction, occupational choice, performance (individual and organizational), commitment (organizational and job), work attitudes and behaviors, perceived supervisor trust, entrepreneurial and social entrepreneurial inclinations, public sector attraction, perceived fit with the public sector, organizational learning, change-oriented organizational citizenship behavior, and leadership (Liu and Perry 2014; Wright and Pandey 2008; Schott and Ritz 2018; Lin et al. 2024; Palma et al. 2021; Chandra et al. 2021; Carpenter et al. 2012; Li and Wang 2022; Chih and Zwikael 2015). Additionally, we contribute to the PS literature by highlighting its mediating role in the PSM-PTLP relationship. Prior research on PS has largely concentrated on its impact on individual and team outcomes such as trust, knowledge sharing, and error reporting (Edmondson 1999; Liu et al. 2014).

Our findings resonate with the growing body of research that emphasizes the positive aspects of public service motivation (PSM) (e.g., Broekema et al. 2019). These studies highlight the potential for PSM to foster positive learning orientations. However, a gap exists in the literature regarding the influence of PSM on learning dynamics within smaller units, such as project teams. This study addresses this gap by examining the relationship between PSM and project team learning process (PTLP) within R&D teams. Shedding light on a critical gap, our study examined the intricate interplay between PM styles, PSM, PS, and PTLP within R&D teams. Interestingly, both fully agile PM and partially agile PM appear to support PSM and PS. These findings suggest that both approaches cultivate environments conducive to nurturing public service motivation and fostering a sense of psychological safety within project teams. However, the field of PM styles in public administration remains underdeveloped. While prior research, such as Istrate and Marian (2012), has explored the use of project management for organizational culture change within public institutions, a comparative analysis of different project management styles has been

largely absent. Our research addresses this gap by examining the differential effects of fully agile and partially agile approaches on PSM, PS, and PTLP.

Furthermore, the stronger positive effect of psychological safety (PS) on project team learning process (PTLP) observed in fully-agile project management (F-APM) suggests a potential explanation. The inherent flexibility and rapid iteration cycle characteristics of F-APM may foster particularly effective environments for team learning. This aligns with the existing research that explores the synergy between PS and agile techniques in the context of team learning. Studies have shown that agile approaches, coupled with PS, can lead to increased knowledge sharing, continuous improvement, collective learning, enhanced team capabilities, and greater customer involvement (Marder et al. 2021; Alami et al. 2022; Barros et al. 2024). Our finding of a weaker direct effect of public service motivation (PSM) on the project team learning process (PTLP) in fully agile project management (F-APM) needs further investigation. This unexpected result raises intriguing questions about the potential moderating role of project management style. One description is that the direct influence of PSM on team learning might be more pronounced in partially agile project environments. Here, the more structured nature of partially agile approaches may provide a more explicit framework for channeling PSM into concrete learning activities.

Alternatively, the weaker effect in F-APM tends to be attributed to specific cultural or contextual factors within the studied teams. The existing research found that employees believe that knowledge, organizational culture, and project management training are essential for success in public administration institutions (Istrate and Marian 2012). These factors might include elements such as the existing hierarchical structure, the level of empowerment granted to team members, or the risk aversion of the project leader. Future research that delves deeper into such contextual elements is necessary to understand their potential influence fully.

Future research could explore these possibilities in greater detail to gain a deeper understanding of the nuanced interaction between project management styles, PSM, and PTLP. However, based on our findings, we can offer some managerial insights for project team leaders, particularly when utilizing a PM styles approach within R&D teams.

1. Fostering a psychological safety climate in project team members when working in F-APM style. Where the direct effect of PSM on PTLP may be weaker, project leaders should actively cultivate a psychological safety (PS) climate. This can be achieved by encouraging open communication, promoting learning from mistakes, and fostering trust within the team. By nurturing a PS climate, project leaders can support and potentially amplify the intrinsic motivation (reflected by PSM) that drives team learning, even in the context of F-APM.
2. Conversely, for project teams lacking a strong PS climate, partially agile project management (P-APM) might be a more strategic approach. The more structured nature of P-APM may provide a clearer pathway for team members with high PSM to translate their intrinsic motivation into concrete learning behaviors. Further research is needed to validate this proposition, but these insights offer a starting point for project leaders navigating the complex interplay between project management styles, PSM, and team learning.

6. Conclusions and Recommendation for Further Studies

This study examined the interplay between public service motivation (PSM), psychological safety (PS), and project team learning process (PTLP) within R&D teams at Thailand's National Electronic and Computer Technology Center (NECTEC). Employing an online survey distributed in 2021, data were collected from 160 R&D professionals. Utilizing partial least squares structural equation modeling (PLS-SEM), the study delves into the complex relationships between these variables, considering the influence of project management (PM) styles.

The path analysis revealed a compelling narrative. Higher levels of PSM were significantly associated with enhanced PS, suggesting that R&D professionals driven

by public service motivation experience greater psychological safety within their teams. Meanwhile, PS fosters a thriving R&D PTLP, as evidenced by the significant positive relationship between PS and PTLP. Interestingly, a direct effect of PSM on PTLP was also observed, indicating that public service motivation can independently contribute to enhanced learning processes within R&D teams. The effect sizes of these relationships ranged from moderate to large, highlighting their practical significance. Further exploration confirmed the partial mediating role of PS in the PSM-PTLP relationship. While higher PSM indirectly influences PTLP through fostering PS, a direct effect also remains, suggesting that public service motivation can contribute to learning processes through other mechanisms beyond enhancing psychological safety.

We found the four points of this key finding. Firstly, the analysis revealed a significant positive relationship between PSM and PS, indicating that R&D team members who are motivated by public service principles report a stronger sense of psychological safety in their teams. Secondly, a positive relationship was also found between PTLP and PS, suggesting that a psychologically safe environment fosters effective team learning processes. Thirdly, the study further identified a crucial link between PSM and PTLP, highlighting the importance of intrinsic motivation, such as PSM, as a novel driver of success in R&D project teams' learning. Finally, the impact of PM styles on these relationships was explored. The results demonstrate that both fully agile and partially agile PM can cultivate environments conducive to PSM, PS, and PTLP, though specific nuances may exist between the two styles.

6.1. Theoretical Contributions

This study contributes to the existing literature in several key areas, offering novel theoretical insights into the relationships between public service motivation (PSM), psychological safety (PS), project team learning process (PTLP), and project management (PM) styles within R&D project teams.

In conclusion, this study makes significant theoretical contributions in the following ways:

1. **Strengthening the understanding of PSM's impact on PS, particularly in the national R&D organization contexts:**
The findings affirm the link between PSM and PS, suggesting that individuals driven by public service values feel more psychologically safe within their teams. This aligns with previous research, highlighting the positive association between public service motivation, open communication, and risk-taking behaviors (Potipiroon and Wongpreedee 2020). However, the study goes beyond confirmation, suggesting that PSM's influence on PS may be particularly important in the national R&D organizations which work with complex goals. This opens avenues for further research to explore the unique dynamics of PSM and PS in different organizational settings.
2. **Highlighting the crucial role of PS in fostering PTLP within R&D project teams:**
This study strengthens the understanding of how PS fosters PTLP. Psychological safety creates an environment where team members feel comfortable sharing ideas, asking questions, and learning from mistakes, encouraging collaborative learning and growth (Edmondson 1999). This finding adds to the existing body of knowledge by specifically demonstrating the relevance of PS in R&D teams, where continuous learning is crucial for technological advancement. This can inform interventions aimed at enhancing PS within R&D teams to optimize learning and innovation.
3. **Identifying a potential direct effect of PSM on PTLP, highlighting the intrinsic motivation associated with public service values which strengthen R&D project team learning:**
An intriguing finding is the direct effect of PSM on PTLP, independent of PS. This suggests that public service motivation may directly motivate individuals to engage in learning activities beyond the mediating role of psychological safety. This aligns with research highlighting the intrinsic learning orientation often associated with PSM (Perry and Hondeghem 2008), suggesting that individuals drawn to public

service are inherently motivated to develop their knowledge and skills to contribute to the greater good. This opens up new avenues for research exploring the specific mechanisms through which PSM directly influences learning, potentially enriching our understanding of individual and team learning dynamics.

4. **Encouraging further investigation into the interaction between PM styles in relation to PSM, PS, and PTLP:**

Investigating the impact of PM styles on these relationships adds valuable nuance to the existing literature. While this study's results suggest both fully agile and partially agile approaches can foster PSM, PS, and PTLP, further investigation into the specific nuances between these styles is encouraged because this result of the dataset is non-significant. This opens up new research possibilities exploring how different PM methodologies may create subtly different environments that impact team motivation and learning processes.

6.2. Practical Contributions

Moreover, this study translates its theoretical insights into several practical contributions that can benefit R&D teams, organizations, and project management approaches in the following ways:

1. **Fostering public service motivation (PSM) among project team members can promote PS, creating a more trusting and collaborative environment:**

The project leader or organization leader can identify individuals motivated by public service motivation (e.g., using validated assessment tools) and emphasize the organization's mission and societal impact during recruitment and onboarding. Leaders can cultivate team members with the drive to contribute to the greater good. The organization can propose training and development programs to promote public service values through case studies, mentorship opportunities, and volunteering initiatives. These activities can further strengthen personal motivation and team cohesion.

2. **Fostering psychological safety (PS) through open communication, error tolerance, and respectful interactions can enhance team learning and performance:**

Project team leaders and members should encourage open communication through regular team meetings, open feedback mechanisms, and active listening practices. These can foster a trusting environment where individuals feel comfortable sharing ideas and concerns. Furthermore, project leaders can implement clear learning guidelines from mistakes, learn new knowledge through trial and error, and demonstrate empathy towards setbacks. It can also promote psychological safety and risk-taking.

3. **Optimizing the project team learning process (PTLP) through strategies encouraging continuous learning, knowledge sharing, and collaborative problem-solving can significantly improve project outcomes:**

An example of the activities is the collaborative learning activities. Project leaders and members should facilitate workshops, set up knowledge-sharing sessions, and provide mentoring programs. These can encourage team members to learn from each other and expand their expertise. Project leaders and members should practice open communication skills, provide constructive feedback, and learn from one another effectively. This can further embed learning into the project team culture.

4. **Understanding the nuances of different PM approaches and their impact on team learning dynamics and learning processes can optimize project management strategies:**

The project leader should select the styles of a PM that are consistent with the context of team member culture. Although this research confirms that both fully agile and partially agile approaches appear conducive to PSM, PS, and PTLP, further research is required in the future for strong confirmation.

5. **Developing and implementing tools to measure PSM, PS, and PTLP within teams can allow for ongoing assessment and inform targeted interventions to address emerging gaps:**

Regular monitoring of these variables can be used to track progress and evaluate the effectiveness of implemented strategies, which the project leader should give priority to concern. Understanding the way each member thinks can help the leader to smoothly operate the project flow.

By implementing these practical recommendations, R&D project teams and organizations can create environments that cultivate public service motivation, foster psychological safety, and optimize R&D project team learning processes, ultimately leading to enhanced innovation and project successes.

6.3. Limitations

While this study sheds light on the interplay between public service motivation (PSM), psychological safety (PS), and research and development project team learning process (PTLP) within a national R&D organization, acknowledging its limitations is crucial for advancing our understanding. These limitations include the following:

- A single organization was focused on this study, potentially limiting the generalizability of the findings to other R&D contexts. Due to time and resource constraints, including budgetary limitations and a strict timeline, we were prevented from expanding the research scope to encompass a more diverse range of R&D settings.
- The sample size of 160 participants is relatively small. While resource limitations restricted our ability to recruit a larger sample, we conducted a pilot study to ensure the validity and reliability of the instruments used and made significant efforts to achieve a diverse sample within the organization.
- The reliance on survey data limits our ability to delve deeper into the mechanisms underlying the relationships between PSM, PS, and PTLP. Surveys inherently struggle to capture the nuances of team-level dynamics and communication patterns that can significantly influence learning behaviors within project teams.
- This study did not consider the potential influence of cultural variations on the relationships between PSM, PS, and PTLP. Cultural norms and values can significantly impact how individuals perceive and experience these variables.
- This study provides a snapshot of the relationships at a single point in time. However, the dynamics of these variables may evolve over time and across different project phases.

By acknowledging these limitations, we can highlight areas for future research and emphasize the need for further exploration of these relationships in different contexts, with larger and more diverse samples, using a wider range of data collection methods that can capture the complexities of team dynamics.

6.4. Future Research

This study lays the groundwork for a deeper understanding of the interplay between public service motivation (PSM), psychological safety (PS), and research and development project team learning process (PTLP). Future research can extend these findings in several compelling directions:

- Future research could address the limitation of broadening the generalizability of the study by investigating these relationships across diverse organizational settings, encompassing different industries, cultures, and project types. By including a wider variety of contexts, researchers can explore how these factors might influence the observed relationships.
- Future research should replicate this study with a larger and more geographically diverse participant pool to address the limitations of generalizability imposed by the sample size. This will enhance the generalizability of the findings and allow for more robust statistical analyses.
- Incorporating qualitative methods can provide a richer understanding of the underlying mechanisms at play. In-depth interviews with team members could explore team discussions, communication styles, and how team members feel comfortable sharing

ideas and admitting mistakes. Additionally, process-tracing techniques that follow teams as they engage in specific activities can provide valuable insights into how PSM, PS, and PTLP interact in real-time project environments.

- Future research should explore how cultural factors might moderate the relationships observed in this study. Cross-cultural comparisons or studies investigating teams from diverse populations can illuminate these potential influences. Understanding the cultural context can provide a more nuanced perspective on how PSM, PS, and PTLP interact within project teams.
- Longitudinal studies that track changes in PSM, PS, and PTLP over time can offer valuable insights into their temporal interactions and how they respond to the evolving dynamics of project environments. Understanding these temporal aspects can inform project management practices and interventions designed to optimize team learning throughout the project lifecycle.

By building on this foundation and addressing the identified limitations, future research can unlock a deeper understanding of how public service motivation and project management styles influence team dynamics and the learning process. This knowledge will equip organizations to make informed decisions about fostering a psychologically safe climate and a collaborative environment, ultimately enabling project teams to successfully learn.

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