

INTERNATIONAL JOURNAL OF ENTREPRENEURSHIP AND MANAGEMENT PRACTICES (IJEMP)





THEORETICAL JUSTIFICATION FOR USING PLS-SEM IN PUBLIC SECTOR RESEARCH ON INNOVATIVE WORK BEHAVIOR

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Article Info:

Article history:

Received date: 27.03.2025 Revised date: 15.04.2025 Accepted date: 15.05.2025 Published date: 04.06.2025

To cite this document:

Yusof, H. S. M., Zahari, A. S. M., & Hamzah, M. I. (2025). Theoretical Justification For Using PLS-SEM In Public Sector Research On Innovative Work Behavior. *International Journal of Entrepreneurship and Management Practices*, 8 (30),125-134.

DOI: 10.35631/IJEMP.830010

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Abstract:

This paper explores the use of Partial Least Squares Structural Equation Modeling (PLS-SEM) as a methodological approach in public sector research, specifically in studying innovative work behavior (IWB). Given the complexity of relationships within public administration, traditional regression-based methods often struggle to capture the nuances of employee behavior and organizational influences. PLS-SEM offers a flexible alternative, allowing researchers to analyze complex models, accommodate small sample sizes, and incorporate both formative and reflective constructs. This study reviews the increasing application of PLS-SEM in public sector research and highlights its methodological advantages. By examining previous studies, the paper demonstrates how PLS-SEM has been effectively utilized to explore factors influencing innovation, employee engagement, and organizational performance in government agencies. It also discusses best practices for applying PLS-SEM, including considerations for model assessment and reporting standards. The findings suggest that PLS-SEM enhances the analytical rigor of public administration research by enabling more precise predictions and theoretical advancements. This paper advocates for its wider adoption and provides recommendations for future research, including expanding theoretical models, applying PLS-SEM across different government contexts, and improving methodological standards to strengthen empirical evidence.

Keywords:

PLS-SEM, Innovative Work Behavior, Public Sector Research, Research Methodology, Structural Equation Modeling

Introduction

In recent years, the concept of innovative work behavior (IWB) has become a hot topic in public sector research, and for good reason. IWB has the potential to transform government organizations by boosting efficiency, improving responsiveness, and raising the quality of services. With globalization, rapidly shifting stakeholder expectations, and growing demands for transparency and accountability, public agencies are under increasing pressure to adapt and innovate. As a result, encouraging civil servants to think outside the box and go beyond their usual tasks has become more essential than ever (Shepel & Pulcha, 2021). For policymakers and administrators, understanding what motivates employees to engage in these creative and proactive behaviors is crucial.

Traditionally, researchers studying IWB in the public sector have relied on conventional methods like regression analysis to examine the factors at play. While these techniques can provide valuable insights, they often struggle to capture the complexity of models that involve multiple interconnected factors. This is especially true for constructs that aren't directly observable such as attitudes, perceptions, or organizational culture. As a result, these methods can fall short when it comes to grasping the nuanced and dynamic nature of innovation in public sector settings.

Due to the changes in the current study, PLS-SEM has become a widely adopted analytical approach among contemporary researchers, particularly in the fields of social sciences and management. Cepeda-Carrion et al., (2022) indicate a growing preference for PLS-SEM among researchers due to the ability to handle complex models and small sample sizes. Moreover, the choice of PLS-SEM is further justified by Suryanto & Rachmawati (2025) who highlight its suitability for novel research models, non-normally distributed data, and complex model structures. PLS-SEM also allows for the estimation of causal relationships grounded in the theoretical framework of the study.

This paper seeks to address this methodological gap by offering a theoretical justification for the use of Partial Least Squares Structural Equation Modeling (PLS-SEM) in the study of IWB within public agencies. The key objectives of the paper are:

- 1. To explain why PLS-SEM is especially well suited for analyzing intricate relationships in public sector research.
- 2. To highlight the methodological strengths of PLS-SEM, such as its capacity to accommodate small sample sizes, non-normal data distributions, and both formative and reflective measurement models.
- 3. To illustrate how PLS-SEM has been applied in previous studies examining innovation-related outcomes in the public sector.

Ultimately, this paper argues that PLS-SEM provides a more flexible and powerful alternative to traditional analytical methods, offering researchers a valuable tool to explore the drivers of innovative behavior among public sector employees.

Theoretical Justification for Using PLS-SEM

Partial Least Squares Structural Equation Modeling (PLS-SEM) has gained significant attention in the social sciences, thanks to its ability to handle complex theoretical frameworks. Its versatility makes it an excellent choice for research in public sector settings, particularly when exploring multifaceted phenomena like innovative work behavior (IWB). PLS-SEM is frequently used in public sector studies that involve complex behavioral constructs such as innovative work behavior, leadership, engagement and psychological capital.

Objective 1: To explain why PLS-SEM is especially well suited for analyzing intricate relationships in public sector research.

PLS-SEM is particularly advantageous in public sector research due to its ability to manage and analyze complex models involving numerous constructs and interrelated paths. This method is known for its effectiveness about relationships between variables, especially in complex models with multiple constructs. This is crucial in the context of public sector organizations where the relationships among transformational leadership, employee voice, psychological capital, and innovative work behavior need to be understood and predicted accurately (Suryanto & Rachmawati, 2025). One of the key strengths of PLS-SEM is its capacity to estimate models with multiple independent and dependent variables simultaneously, making it ideal for examining such intricate dynamics (Hair et al., 2019). Additionally, unlike covariance-based SEM (CB-SEM), which is primarily confirmatory in nature, PLS-SEM emphasizes prediction and theory development. This is especially valuable in public administration research, where theoretical frameworks are still evolving and empirical validation is needed to refine constructs and test emerging relationships (Hair et al., 2017; Sarstedt et al., 2014). Thus, PLS-SEM serves as a robust methodological choice for researchers aiming to explore complex, evolving models within the public sector context.

Objective 2: To highlight the methodological strengths of PLS-SEM, such as its capacity to accommodate small sample sizes, non-normal data distributions, and both formative and reflective measurement models.

PLS-SEM offers several methodological strengths that make it highly suitable for empirical studies in the public sector, where researchers often face constraints related to sample size, data quality, and model structure. One of its most notable advantages is its tolerance for small to medium sample sizes, which is especially relevant in government-related research where access to large respondent pools can be limited (Hair et al., 2019). For instance, Parveen and Alshehri (2023) adopted PLS-SEM to test a mediation model involving transformational leadership, motivation, and innovative work behavior. Their rationale for selecting PLS-SEM was based on its suitability for models with small sample sizes and data that do not meet normal distribution assumptions. Moreover, the model incorporated both reflective constructs (e.g., leadership and motivation), showcasing PLS-SEM's flexibility in measurement model specification. This example reinforces the technique's robustness in exploring complex relationships in organizational settings, particularly when theoretical development is still evolving and traditional covariance-based approaches are less appropriate.

Moreover, PLS-SEM does not assume multivariate normality, making it robust in analyzing data with non-normal distributions—an issue frequently encountered in social science research. In terms of measurement modeling, PLS-SEM can simultaneously handle both reflective and formative constructs, allowing researchers to model complex conceptual frameworks more accurately. This is particularly beneficial in public administration, where constructs like leadership, engagement, and innovation behavior may require different measurement approaches. These strengths position PLS-SEM as a flexible and rigorous tool for studying diverse phenomena in public sector settings.

Objective 3: To illustrate how PLS-SEM has been applied in previous studies examining innovation-related outcomes in the public sector.

PLS-SEM has been increasingly adopted in empirical studies focused on innovation within the public sector, underscoring its practical relevance and methodological flexibility. For example, Zainudin et al. (2025) employed PLS-SEM to examine how individual factors and work engagement contribute to innovative work behavior among Malaysian public servants. Their use of the method allowed for the modeling of complex mediating and moderating relationships, capturing the multifaceted nature of innovation in government settings. Similarly, Aris et al. (2019) utilized PLS-SEM to assess the mediating role of intrapreneurial competencies in the relationship between training and development and innovative work behavior in public organizations. These studies exemplify how PLS-SEM facilitates a comprehensive analysis of both direct and indirect effects, providing richer insights into how various psychological and organizational factors interact to drive innovation in the public sector. The method's adaptability has thus proven vital for exploring dynamic constructs and untested theoretical pathways in real-world public administration contexts.

Literature Review

The application of PLS-SEM in public sector research, especially in studies focused on innovative work behavior (IWB), has gained significant traction in recent years. This method is increasingly favored for its flexibility in handling complex models, mediating and moderating relationships, and its suitability for smaller, non-normal samples often encountered in public administration studies. Previous study, Zainudin et al. (2025) employed PLS-SEM to investigate how individual factors and work engagement influence IWB among Malaysian public servants. Their study demonstrates the method's ability to capture mediating effects and explore behavioral drivers in public sector contexts. Similarly, Aris et al. (2019) utilized PLS-SEM to examine how training and intrapreneurial competencies affect IWB in public organizations, highlighting its strength in evaluating indirect relationships and latent constructs.

In another example, Suryanto and Rachmawati (2025) applied PLS-SEM to test a multifaceted model involving transformational leadership, psychological capital, employee voice, and innovation climate, all contributing to IWB among public sector employees. The complexity of this model underlines PLS-SEM's ability to assess multiple predictors and mediators within a single analysis framework. Moreover, Parveen and Alshehri (2023) used an integrated PLS-SEM approach to examine the mediating roles of IWB and motivation in the relationship between transformational leadership and organizational performance. Their rationale for selecting PLS-SEM was based on its appropriateness for exploratory research, support for reflective constructs, and its ability to handle small sample sizes and non-normal data distributions.

Collectively, these studies provide empirical support for the growing adoption of PLS-SEM in innovation which focused in public sector research and reinforce its methodological advantages. They also serve as practical examples of how PLS-SEM can be employed to derive meaningful insights into behavioral outcomes like IWB within government institutions.

A number of recent publications have successfully applied PLS-SEM to analyze innovation that relate outcomes among government employees, offering both empirical justification and practical precedent for its use. To support the rationale for selecting PLS-SEM in this study, a review of recent empirical research was conducted. Table 1 summarizes key studies that employed PLS-SEM to investigate innovative work behavior in the public sector, highlighting their methodological approaches and identified research gaps.

Methodology

To explore the application of Partial Least Squares Structural Equation Modeling (PLS-SEM) in the study of innovative work behavior (IWB) within the government sector, a systematic literature review was conducted. The objective of the review was to identify and analyze studies that utilized PLS-SEM as a methodology to examine IWB among public sector employees, highlighting trends, theoretical perspectives, and research gaps within this context.

The search process began with a focused strategy using the Google Scholar database. This platform was chosen due to its comprehensive collection of academic articles, conference papers, and other scholarly sources, which ensured a broad coverage of relevant studies. A combination of targeted keywords and Boolean operators was employed to refine the search. These terms included "PLS-SEM," "Innovative Work Behavior," "Public Sector," "Government Employees," "Government Sector," and "PLS-SEM and Innovative Work Behavior." The search was limited to studies published between 2019 and the present to focus on recent advancements in the application of PLS-SEM in the public sector.

To ensure the inclusion of only the most relevant and rigorous studies, specific inclusion and exclusion criteria were established. Only peer-reviewed articles that focused on PLS-SEM as the primary methodological tool and were concerned with innovative work behavior in the context of government or public sector organizations were included. Studies that did not meet these criteria, such as those published before 2019 or those not using PLS-SEM, were excluded from the review.

The initial search yielded a large number of articles, which were subsequently screened for relevance by reviewing the titles and abstracts. Following this, a more in depth full with the text review was carried out to assess the alignment of the studies with the research objectives. This process helped ensure that only studies that directly addressed the relationship between PLS-SEM and innovative work behavior in public sector settings were selected.

Data was extracted from the included studies, focusing on key aspects such as research objectives, sample populations and methodological approaches. The studies were then synthesized thematically to identify common trends in how PLS-SEM was applied within the government sector to examine IWB. The synthesis also provided insight into the strengths and limitations of using PLS-SEM in this context and highlighted areas where further research could contribute to a deeper understanding of innovative work behavior in the public sector.

Table 1: Summary of Empirical Studies Using PLS-SEM to Examine Innovative Work Behavior in the Public Sector

	Sector	Use of PLS-SEM	Relevance	Research Gap / Limitation
Suryanto & Rachmawati (2025)	Public Sector	Used PLS-SEM to test a model involving transformational leadership, organizational identification, psychological capital, innovation climate, and employee voice on IWB.	Demonstrates how PLS-SEM can handle complex multi-variable models in public sector employee behavior.	Focused on Indonesia; lacks exploration in other Southeast Asian government contexts like Malaysia.
Zainudin et al. (2025)	Malaysian Public Sector	Applied PLS-SEM to examine individual factors and work engagement on IWB among public servants.	Shows the suitability of PLS-SEM for measuring mediating effects in the Malaysian public context.	Did not explore moderating effects or broader organizational-level variables.
Aris et al. (2019)	Public Organizations	Used PLS-SEM to analyze training and development impacts on IWB through intrapreneurial competencies.	Illustrates PLS-SEM's capacity to test mediation in behavioral models within public organizations.	Limited scope on individual learning; did not account for organizational climate or leadership.
Parveen & Alshehri (2023)	Mixed (Leadership context, possibly broader than just public)	Used an integrated PLS-SEM model with IWB and motivation as mediators.	Highlights how PLS-SEM supports testing indirect effects and hierarchical models.	Broader context beyond just the public sector; results may lack specificity to government institutions.
Pham et al., (2024)	Public sector (Vietnam)	Validated PLS-SEM as suitable for testing complex mediation in public settings.	Investigated the influence of public service motivation and transformational leadership on IWB and job performance via person for organization fit.	specific cultural or structural variables; no

Theoretical Framework: Social Cognitive Theory

This study is underpinned by Social Cognitive Theory (SCT), developed by Bandura (1986), which posits that human behavior is the result of a dynamic interplay between personal factors, behavioral patterns, and environmental influences as a concept of reciprocal determinism. Central to SCT is the idea of self-efficacy, or an individual's belief in their capacity to execute behaviors necessary to produce specific outcomes (Bandura, 1997). In the context of the public sector, where bureaucratic structures and rigid systems may limit individual autonomy, self-efficacy and personal agency become critical factors in enabling innovative work behavior (IWB).

SCT is particularly relevant for this study as it provides a theoretical basis for understanding how public employees learn from their environment, internalize motivational cues, and initiate innovation oriented behavior. The selected articles in this review reflect constructs and pathways that align with SCT. For example, psychological capital (Suryanto & Rachmawati, 2025), work engagement (Zainudin et al., 2025), and motivational processes influenced by transformational leadership (Parveen & Alshehri, 2023) are all deeply rooted in the cognitive and motivational dimensions emphasized by SCT. These studies suggest that employees' innovative behavior is shaped not only by structural or relational support, but also by internal cognitive mechanisms such as confidence, resilience, and goal-setting as core elements of SCT.

Moreover, SCT's emphasis on observational learning and adaptation is especially pertinent in public service contexts, where employees often model behaviors based on leadership cues or institutional norms (Newman et al., 2018). As innovation in the public sector requires navigating uncertainty and complex stakeholder expectations, the ability of employees to self-regulate and respond proactively to environmental cues as described by SCT is essential. Thus, Social Cognitive Theory offers a robust and contextually appropriate foundation for understanding and analyzing innovative work behavior among government employees.

Contributions to Theory and Practices

The selected studies collectively offer valuable contributions to academic research, public sector practice, and national development initiatives. From a theoretical standpoint, these works extend existing models by integrating behavioral, organizational, and leadership constructs into frameworks that explain innovative work behavior among public sector employees. The use of PLS-SEM in these studies strengthens methodological rigor in the field, particularly by demonstrating its applicability for examining complex mediating and moderating relationships within evolving public administration theories.

Practically, the findings inform public sector leaders and HR practitioners about effective strategies to foster innovation. For example, variables such as transformational leadership, psychological capital, work engagement, and training have been identified as critical enablers of IWB. These insights support the design of leadership development programs and capacity-building initiatives aimed at cultivating innovation-oriented work cultures within government agencies.

At the policy and development level, especially in developing countries such as Malaysia and Vietnam, the evidence derived from these studies aligns with broader public sector transformation agendas. By empirically supporting strategies that enhance innovation and

service delivery, the research contributes to ongoing efforts to improve public sector performance, attract foreign investment, and fulfill national development visions.

Findings and Implications for Future Research

Recent studies emphasize the increasing adoption of Partial Least Squares Structural Equation Modeling (PLS-SEM) as a powerful analytical method for examining innovative work behavior in public sector settings. The reviewed literature such as Zainudin et al. (2025), Suryanto & Rachmawati (2025), and Aris et al. (2019) demonstrates how PLS-SEM enables the modeling of complex relationships involving leadership, psychological capital, work engagement, and innovation climate. These studies highlight the method's strength in handling multidimensional constructs and estimating both direct and indirect effects.

In particular, PLS-SEM has proven suitable for studies with small to moderate sample sizes (e.g., Parveen & Alshehri, 2023), non-normal data distributions, and models involving mediators such as motivation or intrapreneurial competencies. This methodological flexibility has facilitated empirical contributions to theory development in public administration, especially where constructs like IWB, leadership, and employee engagement are still evolving.

Key Insights from Existing Research

PLS-SEM improves predictive accuracy in modeling behavioral constructs like IWB and psychological capital (Suryanto & Rachmawati, 2025). It supports multidimensional modeling, including mediating effects of constructs like work engagement (Zainudin et al., 2025) and intrapreneurial competencies (Aris et al., 2019). Studies in Southeast Asia, including Malaysia and Vietnam, confirm the relevance of PLS-SEM in diverse public administration contexts (Pham et al., 2024).

Future Research Directions

Expand Theoretical Models: Future studies should incorporate additional mediators (e.g., interpersonal trust, organizational identification) and moderators (e.g., silo mentality, leadership style) to better explain variations in IWB.

Broaden Contextual Application: PLS-SEM should be applied across various types of public agencies, including ministries involved in international trade and investment, to compare innovation-related dynamics in different administrative settings.

Strengthen Methodological Rigor: Researchers should ensure alignment with best practices in PLS-SEM, including clear model specification, adequate sample size, and robust validation techniques, as recommended by Hair et al. (2019).

By addressing these directions, future research can offer richer, more context-sensitive insights into how government organizations cultivate innovation among public servants, especially in developing countries like Malaysia.

Conclusion

Partial Least Squares Structural Equation Modeling offers a compelling methodological framework for studying innovative work behavior within public sector agencies. Its strengths in managing complex relationships, accommodating small sample sizes, and handling non-normal data make it exceptionally suited for research on innovation in government organizations. PLS-SEM aligns closely with the realities of public sector studies, which often

face challenges such as limited data collection opportunities, evolving theoretical models, and the need for strong predictive accuracy.

Moreover, its ability to model latent constructs for both formative and reflective which enables researchers to gain deeper insights into innovation-related behaviors and dynamics. By leveraging this methodological approach, studies can shed light on critical factors such as leadership, motivation, and organizational commitment, thereby providing a nuanced understanding of how innovation unfolds in public institutions.

As governments continue to prioritize innovation as a strategic goal, researchers are encouraged to tap into the strengths of PLS-SEM to generate fresh insights, guide policy decisions, and contribute to the broader theoretical development of public administration research (Hair et al., 2017; Shmueli et al., 2016).

Acknowledgements

The authors would like to express sincere gratitude to the editorial team and reviewers for their valuable feedback and constructive suggestions, which significantly improved the quality of this paper. Appreciation is also extended to the organizers of the International Conference of Sciences, Ethics, and Civilizations (KonSEP 2025) for the opportunity to present and publish this work. Finally, heartfelt thanks are due to colleagues for the support that contributed to the completion of this research.

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