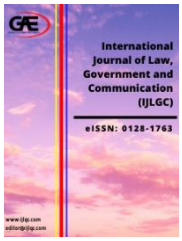
International Journal of Law, Government and Communication
EISSN : 0128-1763
Volume 10 Issue 40 (June 2025) PP. 115-125
DOI 10.35631/IJLGC.1040009



INTERNATIONAL JOURNAL OF LAW, GOVERNMENT AND COMMUNICATION (IJLGC)
www.ijlgc.com

ENHANCING TERMITE PEST CONTROL SERVICES IN HOUSING DEVELOPMENTS: A CONCEPTUAL ANALYSIS OF LOCAL AUTHORITY INTERVENTIONS IN PERAK TENGAH, MALAYSIA

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Article Info:

Article history:
Received date: 27.03.2025
Revised date: 14.04.2025
Accepted date: 15.05.2025
Published date: 05.06.2025

To cite this document:

Khalid, M. K. A., Zawawi, Z. A., Ahmad, N. A., Khalid, I. L., & Mustapha, A. (2025). Enhancing Termite Pest Control Services In Housing Developments: A Conceptual Analysis Of Local Authority Interventions In Perak Tengah, Malaysia. *International*

Abstract:

In Perak Tengah, effective termite control is essential to preserving the structural integrity of buildings and protecting public health. However, current pest management approaches face challenges such as poor regulatory enforcement, limited use of modern technology, and weak cooperation between public and private sectors. This paper examines how local authorities can improve termite control services for residential developments in their jurisdiction. The study is based on the Integrated Pest Management (IPM) model (Ebeling, 1975) and the Public Service Delivery Model (Osborne, 2010). It evaluates current policies, processes, and stakeholder involvement in termite control. The paper argues that a multi-stakeholder approach, including collaboration between local government, pest control operators, and homeowners, is key to achieving effective and sustainable pest management. Lessons from international best practices in urban pest control (Su & Scheffrahn, 2000) offer valuable insights for improving service delivery in Perak Tengah. This study contributes to urban pest management discussions by identifying gaps in current policies and suggesting an intervention model for local authorities to enhance termite control. The findings aim to help

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Journal of Law, Government and Communication, 10 (40), 115-125.

DOI: 10.35631/IJLGC.1040009

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policymakers streamline pest control regulations, improve monitoring systems, and develop public awareness programs. Future research should focus on assessing the impact of these policies on termite infestations and evaluating the economic effects on housing developments.

Keywords:

Housing Development, Local Authority, Majlis Daerah Perak Tengah, Pest Management, Public Service Delivery Model, Termite Control

Introduction

Termite infestations present a significant challenge to housing developments, especially in tropical climates such as Malaysia, where high humidity promotes termite proliferation (Lee et al., 2018). The Perak Tengah Local Authority (PTLA) handles urban development and public services within its jurisdiction, including pest control management. However, despite existing pest control laws, many housing developments continue to experience severe termite damage, leading to substantial economic losses and structural deterioration (Su & Scheffrahn, 2000). Local authorities play a crucial part in mitigating these infestations, yet gaps remain in policy enforcement, stakeholder coordination, and sustainable pest control strategies. Research Problem The main issue addressed in this study is the effectiveness of termite pest control services under PTLA's jurisdiction.

Figure 1: Termite Infestation in Local Authority Service Areas of Housing Developments in Perak Tengah

While local authorities implement pest management policies, challenges such as inadequate enforcement, lack of public awareness, and inconsistent collaboration with private pest control operators remain (Rahmat et al., 2021). Furthermore, conventional chemical-based methods often provide only brief relief, necessitating a more integrated and proactive approach can be seen in figure 1. Another issue relates to this paper refers to table 1 below.

Table 1: Related Issues for This Paper

Issue	Description	Supporting Citation
1. High Rate of Termite Infestations	Subterranean termites (especially *Coptotermes* species) cause major structural damage in tropical areas.	Jasmi, A. H. (2016) found widespread termite infestations, leading to major maintenance costs.

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2. Reactive Rather Than Preventive Control Measures	Current termite management practices are often reactive, focusing on chemical treatment after infestation, rather than preventive actions during housing development.	Ahmad, F. et al. (2021) noted homeowners spend millions annually due to late-stage termite control.
3. Weak Enforcement of Pest Control Regulations	Local authorities, including those in Perak Tengah, often lack strict regulations or enforcement mechanisms for termite prevention in new housing projects.	Rahmat et al. (2021) highlighted inconsistent enforcement of pest control policies across Malaysian municipalities.
4. Lack of Integration of Termite Control into Urban Planning	Termite control is not systematically included in housing design and construction phases, missing an opportunity for long-term prevention.	Chouvenc et al. (2016) suggested that termite management should be integrated early into urban development plans.
5. Limited Public-Private Sector Collaboration	Collaboration between local authorities and private pest control companies is weak, leading to inefficiencies and underutilization of technology.	Tan & Lim (2022) found public-private partnerships in Malaysian pest control services remain underdeveloped.
6. Low Public Awareness and Engagement	Homeowners often lack knowledge about termite prevention, leading to delayed detection and larger infestations.	Hassan, B., & Nanda, M. A. (2024) emphasized the importance of community involvement in successful pest management programs.
7. Absence of Sustainable, Long-term Pest Control Strategies	Most termite control relies heavily on chemical solutions, with little emphasis on sustainable or environmentally friendly methods.	Vongkaluang et al. (2018) stressed the importance of adopting IPM (Integrated Pest Management) strategies for sustainable urban termite control.

Termite infestations are a major problem for housing developments in Perak Tengah, Malaysia. Around 35–40% of buildings face termite attacks within 5–10 years of construction (Ahmad, F. et al.,2021). Homeowners and businesses spend about RM100 million each year on termite repairs and treatments (Jasmi, A. H.,2016). Most control methods (80%) still rely on chemicals rather than sustainable solutions (Vongkaluang et al., 2018). Only 20% of local councils enforce preventive termite measures (Rahmat et al., 2021). Poor public awareness and weak collaboration with pest control companies worsen the issue. Repair costs per home range between RM2,000 and RM10,000 (Hashim & Hassan, 2019).

This conceptual paper aims to explore the weaknesses of current termite control strategies and propose a better framework for improving local authority efforts. It is based on two main theories: Integrated Pest Management (IPM) and Public Service Delivery Theory. IPM promotes a sustainable approach by combining biological, mechanical, and chemical methods to reduce heavy pesticide use (Ebeling, 1975). Public Service Delivery Theory highlights the

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role of governance and stresses collaboration between government, private companies, and communities (Osborne, 2010). By integrating these theories, the paper examines how local authorities can strengthen their termite control policies. It argues that a multi-stakeholder approach—combining regulation, technology, and public participation—is crucial for better termite management in Perak Tengah's housing areas. Drawing lessons from international best practices (Su & Scheffrahn, 2000), it offers policy recommendations for improving PTLA's pest control services. The paper also encourages future research to study the real-world impacts of these strategies in Malaysia.

Literature Review

The literature shows the multidimensional character of termite management, combining scientific, regulatory, and governance components in Table 2.

Table 2: Multidimensional Character of Termite Management, Combining Scientific, Regulatory, and Governance Components

Section	Simplified Content
1. Importance of Termite Pest Control	Termites, especially in tropical areas like Malaysia, cause serious damage to homes, leading to high costs (Su & Scheffrahn, 2000). Many homeowners spend a lot on treatment, but short-term solutions often fail (Ahmed et al., 2020). Experts suggest better long-term strategies and preventive measures during construction (Rahmat et al., 2021). However, there is little research on the role of local authorities in enforcing termite control policies.
2. Integrated Pest Management (IPM)	IPM is a sustainable way to control pests using biological, mechanical, and chemical methods (Ebeling, 1975). Studies show that combining soil treatment, barriers, and biological control can reduce termites in housing areas (Vongkaluang et al., 2018). However, local authorities face challenges in enforcing IPM due to inconsistent regulations (Chouvenc et al., 2016). Research is needed to see if Perak Tengah's governance can support IPM strategies.
3. Role of Local Authorities	Pest control is not just a scientific issue but also a governance challenge (Osborne, 2010). In Malaysia, local councils are responsible for pest control, but efforts are often uncoordinated (Rahmat et al., 2021). Some councils enforce strict termite treatment rules, while others do not (Hashim & Hassan, 2019). This inconsistency suggests a need for standardized policies in Perak Tengah.
4. Public-Private Partnerships (PPPs)	Working with private pest control companies can improve services (Su & Scheffrahn, 2000). Other countries have successfully used PPPs to enhance urban pest management. In Malaysia, PPPs are underdeveloped due to regulatory and financial barriers (Tan & Lim, 2022). Policy changes could help integrate private companies into government programs.
5. Challenges and Future Directions	More research is needed to combine scientific and policy perspectives on termite control. Few studies assess the actual impact of municipal programs (Lee et al., 2018; Rahmat et al., 2021). Field studies in Perak Tengah could help refine policies. Learning from global best practices, such as those in Australia and Japan, may improve Malaysia's termite management strategies.

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While IPM presents a promising theoretical framework, its execution remains inconsistent at the local level. Local authorities, notably in Perak Tengah, confront major obstacles in enforcing termite control policies and promoting collaboration with private parties. Addressing these shortcomings demands a more integrated approach that blends sustainable pest management tactics with appropriate governance frameworks. Future study should focus on empirical assessments of local authority actions and the potential for public-private partnerships to enhance termite management services in Malaysia.

Method of Study

This conceptual paper utilizes a **theoretical analysis** approach to explore and propose improvements to termite control strategies in Perak Tengah. The study is grounded in two key theories Integrated Pest Management (IPM) Theory and Public Service Delivery Theory. The study synthesizes these theories to analyze existing termite control policies and practices and uses international best practices as a basis for proposed improvements. The study also encourages empirical research to assess real-world impacts on termite management.

Theoretical and Conceptual Framework

Theoretical and Conceptual Framework Effective termite pest control in housing developments requires a multidisciplinary approach that combines environmental science, governance, and public service delivery. This study draws on two key theoretical frameworks—Integrated Pest Management (IPM) and Public Service Delivery Theory, to analyze how local authorities in Perak Tengah can improve termite control services. The integration of these theories gives a holistic knowledge of both the technical and administrative aspects of urban pest management.

Theoretical Framework

Integrated Pest Management (IPM) Theory

The Integrated Pest Management (IPM) framework, originally developed in the field of agricultural pest control, has been widely adopted in urban pest management due to its sustainable, multi-faceted approach (Ebeling, 1975). IPM emphasizes the use of environmentally friendly control methods, including biological, mechanical, and chemical strategies, to reduce reliance on toxic pesticides while ensuring long-term pest mitigation (Lee et al., 2018).

In the context of termite management in Perak Tengah, the IPM framework suggests that local authorities should:

- Implement preventive measures, such as soil treatment, baiting systems, and termite-resistant building materials.
- Promote biological control, including the use of natural termite predators and fungi-based treatments.
- Encourage public awareness and community participation in early detection and control efforts.

By applying the IPM framework, this study argues that local governments can develop a more effective, proactive approach to termite management rather than relying on reactive extermination measures.

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EISSN : 0128-1763
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Public Service Delivery Theory

Governance and service efficiency play a crucial role in determining the success of pest control programs. Public Service Delivery Theory, as proposed by Osborne (2010), focuses on how government agencies provide essential services to the public, emphasizing the importance of stakeholder collaboration, policy effectiveness, and resource allocation.

Within the termite control context, Public Service Delivery Theory suggests that:

- Local authorities must establish clear regulatory frameworks for termite management in housing developments.
- Collaboration with private pest control firms can improve service efficiency and access to advanced treatment technologies.
- A performance-based monitoring system should be introduced to ensure accountability and measure the effectiveness of pest control initiatives.

By combining these governance principles with the technical aspects of IPM, local authorities in Perak Tengah can enhance their termite control services through integrated regulatory and operational strategies.

Conceptual Framework

Based on Table 3 these theoretical foundations, the conceptual framework (see Figure 2) illustrates how termite pest control services can be improved through an integrated approach.

Table 3: Key Components of the Conceptual Framework

Component	Description
Local Authority Policies	Policy implementation, regulatory enforcement, and coordination with stakeholders to ensure effective termite control.
Integrated Termite Control Strategies	Adoption of preventive, biological, and sustainable pest control methods to reduce long-term termite infestations.
Private Sector Involvement	Partnerships between government agencies and private pest control companies to improve service efficiency and access to advanced technologies.
Community Engagement	Involves public awareness campaigns, homeowner involvement, and early detection programs to enhance proactive termite management.
Sustainable Housing Development	Ensuring long-term termite control in housing projects through proactive planning, construction techniques, and regular monitoring.

A proposed diagram would demonstrate the relationships between these components, showing how government, service delivery, and scientific pest management combine to promote termite control efforts in Perak Tengah.

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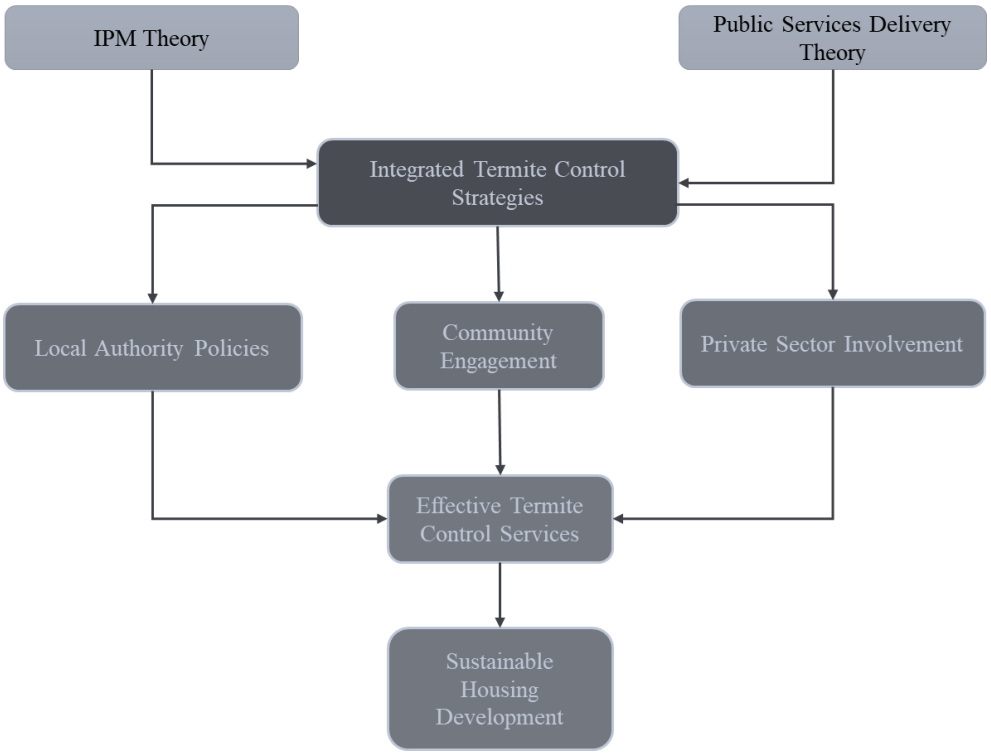

Figure 2: Conceptual Framework for Enhancing Termite Pest Control Services

Conclusion The merger of Integrated Pest Management (IPM) Theory and Public Service Delivery Theory gives a structured approach to assessing the effectiveness of termite control services. While IPM provides sustainable pest management technologies, public service delivery principles underline the role of governance and stakeholder participation in increasing service efficiency. By embracing these theoretical approaches, this study offers a comprehensive conceptual paradigm for increasing Majlis Daerah Perak Tengah initiatives in termite management.

Future Work and Conclusion

Analysis Findings

The conceptual framework combines Integrated Pest Management (IPM) and Public Service Delivery Theory to improve termite control in housing developments. IPM focuses on sustainable pest control methods, such as monitoring, biological control, and reducing chemical use. Public Service Delivery Theory highlights the importance of governance, policy enforcement, and collaboration among stakeholders for effective service delivery.

These theories work together to influence key factors like local authority regulations, private sector involvement, and community engagement. Local authorities set regulations, fund initiatives, and monitor progress. The private sector provides innovative, cost-effective solutions, while community engagement ensures awareness and compliance with termite control practices.

By integrating these components, the framework promotes efficient termite control with early detection, reduced environmental impact, and sustainable housing development. This approach minimizes damage and financial losses from termite infestations, emphasizing the need for a

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multi-stakeholder model that combines science, governance, and public participation for effective urban pest management.

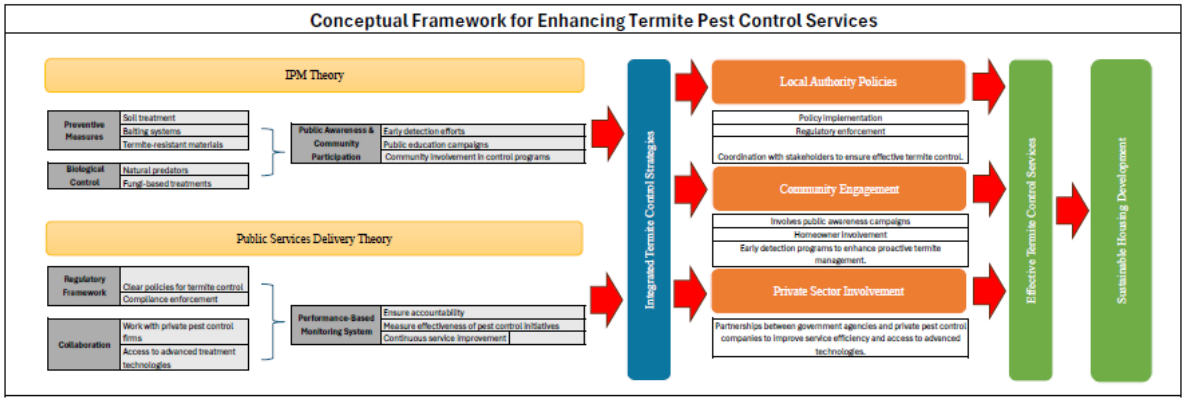

Figure 3: This Model Provides a Foundation for Further Empirical Research, Ensuring Practical and Policy-Driven Improvements in Termite Control Services at Majlis Daerah Perak Tengah.

Discussion

The proposed framework combines Integrated Pest Management (IPM) Theory and Public Service Delivery Theory to improve termite control in Perak Tengah's housing developments. This approach helps connect pest control strategies with governance, ensuring more effective local government interventions. While previous studies have focused separately on pest control (Lee et al., 2018) or governance (Osborne, 2010), this study combines both perspectives for a more comprehensive solution.

Theoretical Contributions

Applying IPM Theory in housing developments highlights the need for long-term, eco-friendly termite control methods instead of relying only on chemical treatments (Ebeling, 1975). This study extends IPM beyond farming and commercial use, highlighting its usefulness in urban planning. Meanwhile, Public Service Delivery Theory describes how governance affects pest control. Effective termite management requires coordinated policies, law enforcement, and community involvement. This paradigm indicates that municipal governments should engage with private pest control firms and community organizations to improve service delivery (Rahmat et al., 2021).

Strengths of the Framework

1. Interdisciplinary Approach — Combines scientific pest management technologies with governance measures for a well-rounded solution.
2. Adaptability – The framework can be modified based on different environmental, legal, and economic conditions.
3. Public-Private Partnerships – Encourages local governments to partner with private pest management companies, ensuring cost-effective and technologically advanced solutions, comparable to successful programs in Australia and the U.S. (Su & Scheffrahn, 2000).
4. Community Involvement – Highlights the importance of public participation, including awareness campaigns and homeowner engagement in termite prevention.

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Practical Applications

This approach can aid academia, urban planners, legislators, and industrial pest control professionals in various ways:

Table 4: Key Contributions to The Academic, Industry, And National Levels

Category	Contributions
Academia	• **Advances theoretical frameworks** by integrating IPM and Public Service Delivery Theory.
	• Promotes **interdisciplinary research** between environmental science and public administration.
	• **Innovates policy** recommendations for pest control in urban settings.
Industry	• **Improves pest control practices** by promoting eco-friendly and efficient methods.
	• Supports the adoption of **sustainable** practices in pest control, reducing reliance on harmful chemicals.
	• Encourages **public-private partnerships** for **better collaboration** and **resource sharing** in pest management.
Nation	• **Improves public health** by reducing structural damage from termites and protecting buildings.
	• **Reduces economic costs** of termite damage, saving homeowners and developers significant expenses.
	• Supports **sustainable urban development** aligned with Malaysia's long-term environmental goals.

Based on table 5, Local governments can utilize it to establish better termite control programs and integrate pest management into city planning. Housing developers can apply termite-resistant building techniques to reduce long-term repair costs. Municipal pest control systems can be improved by adding regular monitoring, IPM tactics, and better service delivery mechanisms. By merging scientific pest control methods with governance principles, this framework provides a strategic guide for sustainable termite control in Malaysia and beyond.

Future Work

While this conceptual study presents a comprehensive framework for enhancing termite pest control services in housing developments, several research gaps remain. Future studies should focus on empirical validation of the framework, evaluating its effectiveness in real-world settings can refer in Table 4. Field studies in Perak Tengah could provide quantitative data on termite infestation rates, policy implementation challenges, and the impact of public-private collaborations.

Table 5: Future Work for This Study

Key Area	Simplified Description	Future Directions
Empirical Validation and Case Studies	Study termite control over time in places like Perak Tengah and compare with other areas. Use GIS and remote sensing for better monitoring.	• Long-term case studies. • Compare areas with strong vs. weak regulations. • Use technology to improve data collection.

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Expanding to Other Urban Pests	Apply the termite control framework to manage other pests like mosquitoes and rodents.	• Adapt IPM (Integrated Pest Management) for other urban pests. • Explore broader urban pest control strategies.
Policy Evaluation and Stakeholder Views	Understand how different stakeholders view and deal with termite control policies.	• Gather feedback from local authorities, pest control firms, and homeowners. • Identify challenges and policy barriers through surveys and interviews.

Acknowledgment

This paper would like to express sincere gratitude to all individuals and organizations who contributed to the development of this conceptual paper. Special thanks are extended to the academic faculty members at Universiti Teknologi Mara and University Malaya for their guidance and support throughout the research process.

Appreciation is also due to the Perak Tengah Local Authority (PTLA) or Majlis Daerah Perak Tengah for providing valuable insights into local pest management policies and practices. The contributions of pest control professionals, housing developers, and community representatives who shared their experiences and perspectives were instrumental in shaping the direction of this study.

Finally, the contributions of previous researchers whose work on Integrated Pest Management (IPM), public service delivery, and urban pest control laid the foundation for this paper. Their scholarly efforts continue to inspire improvements in sustainable pest management practices.

Conclusion

The conceptual framework outlined in this study lays a foundation for improving termite pest control services in housing developments at Majlis Daerah Perak Tengah. However, future empirical studies are necessary to test its applicability, effectiveness, and scalability. By addressing these research gaps, policymakers and urban planners can develop data-driven, sustainable pest control strategies that enhance urban resilience against termite infestations.

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