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Muhammad Nazrul Abd Rani & Rasyikah Md Khalid

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Legal frameworks and mechanisms for resolving transboundary water disputes in Malaysia: insights from the Kedah-Penang Muda River dispute

Muhammad Nazrul Abd Rani [a] and Rasyikah Md Khalid [b]

[a]School of Law, Universiti Utara Malaysia, Sintok, Malaysia; [b]Faculty of Law, Universiti Kebangsaan Malaysia, Selangor, Malaysia

ABSTRACT

The ongoing water dispute between Kedah and Penang over the shared use of the Muda River highlights critical inadequacies within Malaysia's legal framework for managing inter-state water disputes. This paper employs a doctrinal legal research approach to analyse relevant statutes, international water law principles and Malaysia's integrated water resources management (IWRM) and integrated river basin management (IRBM) policies. The objective of this study is to identify legal gaps and challenges within the current framework and to propose actionable solutions for effective dispute resolution. The findings reveal significant legal gaps, particularly in compensation mechanisms and inter-state coordination, that hinder effective dispute resolution within a federated governance structure. To address these issues, the study recommends legal reforms and an establishment of a federal mediation entity. These measures are designed to foster equitable and sustainable water management practices, contributing to Malaysia's alignment with SDG 6 on clean water access and sustainability.

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Introduction

Water disputes between states have emerged as a pressing issue in Malaysia, particularly as the country continues to navigate the challenges posed by rapid economic development, urbanization and environmental pressures. One of the most prominent examples is the ongoing dispute between Kedah and Penang over the shared use of the Muda River, which originates from Kedah's Ulu Muda catchment area and serves as a crucial water source for Penang (New Straits Times, 2024). While Kedah, as the upstream state, has long sought compensation for Penang's usage of raw water, Penang maintains that it has the rights to abstract water from the river based on riparian principles. This dispute highlights the inadequacies and ambiguities within Malaysia's legal frameworks governing water resource management and inter-state disputes as well as the country's broader challenges in meeting Sustainable Development Goal 6 (SDG 6), which emphasizes equitable and sustainable water management (United Nations, 2015).

CONTACT Muhammad Nazrul Abd Rani m.nazrul.abd@uum.edu.my
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The existing legal structures, including the Federal Constitution, state water enactments, international water law principles, Malaysia's integrated water resources management (IWRM) and integrated river basin management (IRBM) initiatives, provide federal and state roles in water governance. Despite these legal frameworks, the dispute over the Muda River between Kedah and Penang remains unresolved, highlighting critical gaps in the statutory regime. These gaps reveal limitations in addressing inter-state water disputes effectively within Malaysia's federated governance structure, especially in terms of coordination, compensation and enforcement mechanisms. This paper aims to explore the effectiveness of these legal frameworks in managing inter-state water disputes, using the Muda River dispute between Kedah and Penang as a case study. It critically examines how the federal and state jurisdictions, as outlined in the Federal Constitution, contribute to the complexities of dispute resolution.

Furthermore, this study draws insights from international water law principles and examines how they can be adapted to the Malaysian context to promote equitable and sustainable water sharing between states. The paper also evaluates the current implementation of IWRM and IBRM in Malaysia and its potential role in mitigating inter-state water disputes. Towards this end, it identifies the legal gaps that hinder effective IWRM and IRBM and proposes recommendations for developing a more cohesive and comprehensive legal framework to resolve inter-state water disputes in Malaysia.

Methodology

This study employs a doctrinal legal research approach to investigate the existing legal frameworks governing transboundary water disputes in Malaysia, with a specific focus on the Kedah-Penang dispute over Muda River. Doctrinal research is particularly well-suited for legal scholarship as it allows for a detailed examination of statutes, case law and policies, providing a comprehensive assessment of both domestic and international legal principles applicable to this context (Hutchinson & Duncan, 2012). The analysis is guided by Section 17A of the Interpretation Acts 1948 and 1967, which requires that statutes be interpreted to fulfil their intended purpose. This guiding principle supports a focused examination of where current statutes fall short in managing inter-state water disputes effectively. For example, areas where statutes lack clarity or fail to provide concrete dispute resolution mechanisms are highlighted in this analysis as critical gaps that hinder sustainable water management. This approach enables the identification of missing components essential for effective transboundary water cooperation, such as compensation frameworks and cooperative mechanisms.

In addition, this study draws upon international standards and guidelines, specifically the Supplementary Building Blocks for Transboundary Water Cooperation from the United Nations, as a benchmark to evaluate Malaysia's framework. These building blocks, covering procedural and substantive elements, are crucial to transboundary water governance, providing a foundation to assess whether Malaysia's legal provisions align with best practices. The framework highlights components like joint monitoring, dispute resolution, public participation, and mechanisms for cooperation, which were used to systematically identify deficiencies within Malaysia's existing laws.

The research is structured around three analytical frameworks. Firstly, the study analyses primary legal sources, focusing on key legal documents such as the Federal

Constitution of Malaysia and state water enactments. This is to understand how jurisdiction on the water sector is distributed between federal and state governments, which forms a critical aspect in understanding the complexities of inter-state water disputes. Secondly, the study integrates international water law principles, particularly the Helsinki Rules (1966) and the Convention on the Law of the Non-Navigational Uses of International Watercourses (United Nations, 1997), as they offer valuable insights into managing shared water resources. The study compares Malaysia's legal framework with these international norms to assess how principles such as 'equitable and reasonable use' and 'no significant harm' can be applied to the Malaysian context. Thirdly, the Kedah-Penang dispute itself is analysed as a case study to illustrate the practical application of these legal principles, highlighting both the strengths and weaknesses of Malaysia's approach to transboundary water disputes.

The doctrinal analysis involved a systematic examination of statutory provisions, and academic commentary. Primary legal documents, such as the Federal Constitution and state water enactments, were scrutinized to identify the legal basis for water resource management and inter-state dispute resolution (Federal Constitution, 1957; Water Act, 1920; Kedah Water Resources Enactment, 2008; Water Services Industry Act, 2006, Kedah and Penang (Alteration of Boundary) Act 1985; Penang Water Supply Enactment 1998). Academic literature and government reports were also consulted to supplement the analysis, ensuring that the study is grounded in a comprehensive understanding of Malaysia's water governance challenges.

The data collection process for this study involved sourcing primary and secondary data from various legal databases and academic journals. Primary data were obtained from legal statutes, constitutional provisions and international instruments, while secondary data comprised academic articles, books and policy papers sourced from reputable databases such as Scopus, JSTOR, Taylor & Francis Online, SpringerLink and Google Scholar. This comprehensive data collection ensured that the analysis was both thorough and informed by the latest developments in water law and governance.

It is important to acknowledge certain limitations inherent in this methodology. While the doctrinal analysis offers a robust framework for understanding the legal aspects of water disputes, it does not incorporate empirical data such as interviews or stakeholder perspectives, which could provide additional insights into the practical challenges faced in resolving the Kedah-Penang dispute (Hutchinson, 2013). Nevertheless, by drawing on a wide range of legal sources, academic literature and international comparisons, this study provides a multi-faceted analysis of Malaysia's transboundary water governance.

Transboundary water dispute

Transboundary water disputes often arise from competing interests among riparian states, necessitating a robust legal framework to facilitate negotiation and cooperation (Alsaadi et al., 2020). An effective water-sharing agreement should incorporate flexibility to adapt to changing environmental conditions and socio-economic factors. Ward (2012) emphasizes that flexible agreements can lead to a more predictable water supply and greater incentives for infrastructure development, thereby enhancing cooperation among riparian states. Similarly, Falkenmark et al. (2009) argue that increasing water interdependence among basin states requires institutional preparedness and adaptable water-

sharing arrangements to mitigate potential conflicts This is crucial to mitigate climate change impact on water resources (Bhaduri et al., 2011).

The historical context of water-sharing agreements also plays a vital role in shaping contemporary disputes. The case of the Grand Ethiopian Renaissance Dam (GERD) illustrates how historical treaties can create conflicting interests among states, complicating negotiations (Endaylalu, 2024). According to Endaylalu (2024), the 1929 and 1959 agreements regarding the Nile River have been criticized for favouring certain riparian states, leading to ongoing tensions and disputes over water allocation.

Moreover, the literature highlights the importance of cooperative frameworks in managing transboundary water resources. It is argued that shared water resources can serve as a basis for cooperation and benefit-sharing, provided that collaborative structures are established to recognize and address threats to these resources (Uitto & Duda, 2002). This perspective aligns with the findings of Giordano and Wolf (2003) that emphasize the need for international cooperation in managing transboundary freshwater resources to prevent conflicts. The establishment of joint management institutions can facilitate dialogue and foster trust among riparian states, ultimately leading to more sustainable water-sharing agreements.

Legal mechanisms for resolving transboundary water disputes must also consider the socio-political dynamics that influence negotiations. Zeitoun and Mirumachi (2008) challenge the binary view of conflict and cooperation, suggesting that both can coexist in transboundary water management contexts. The involvement of local communities and stakeholders in the decision-making process is essential for ensuring that water-sharing agreements are equitable and sustainable (Black & McBean, 2017). Furthermore, the role of indigenous rights and local knowledge in water management cannot be overlooked. Black and McBean (2017) also emphasize the need for meaningful engagement with indigenous communities in water management policies, as their involvement can enhance the sustainability of water resources.

The literature also underscores the significance of empirical evidence in shaping water-sharing agreements. For instance, Talozi et al. (2019) advocate for a reassessment of existing agreements based on changing demographic and environmental conditions, highlighting the need for renegotiation to achieve equitable outcomes. In addition to historical and socio-political considerations, the economic implications of water-sharing agreements are critical for fostering cooperation. Bhaduri et al. (2011) demonstrate that countries can achieve sustainable transboundary water sharing through cooperative economic frameworks, particularly in the face of climate change. The integration of economic incentives into water-sharing agreements can enhance compliance and promote collaborative management among riparian states.

The challenges of water scarcity and competing demands further complicate transboundary water management. Draper (2012) emphasizes the necessity of creating and enforcing effective water-sharing agreements to address the growing challenge of water scarcity. The literature also highlights the importance of scientific research and data in informing water management decisions. Wine (2019) argues that strong scientific inference is essential for equitable water sharing, particularly in securitized transboundary watersheds. The integration of scientific data into the negotiation process can enhance transparency and trust among riparian states, facilitating more effective conflict resolution.

Historical background of Kedah – Penang water dispute

The water dispute between Kedah and Penang is not merely a contemporary challenge but one deeply rooted in historical, geographical, political and socio-economic factors. Kedah, with its rich history as one of Malaysia's oldest states, has long served as a crucial water source for neighbouring regions, particularly Penang. The Muda River basin (MRB), which straddles both states, remains a linchpin in this dynamic, supplying over 80% of the combined water needs of Kedah and Penang (Azhar, 2021; Zhang et al., 2020). The dispute's historical context traces back to the Kedah Sultanate era, when water resources were vital for sustaining populations and agriculture, emphasizing Kedah's longstanding role as a water provider (Abdullah & Noor, 2018).

The colonial period introduced a structured administration of water resources, but it also marked the inception of inter-state tensions. Penang's rapid urbanization and industrial expansion during this era increased its dependency on water from the Muda River, leading to resource-sharing conflicts with Kedah (Abdullah & Noor, 2022). By 1965 to 1981, cooperation and contention over water supply between Kedah and Penang became evident, with both states facing growing populations and industrial demands, revealing the inherent challenges in managing shared resources within a federal framework (Abdullah & Noor, 2022).

In recent years, environmental degradation and pollution have aggravated the situation, particularly within the MRB. Forest harvesting in the Ulu Muda Forest, a crucial water catchment area in Kedah, poses a direct threat to water availability and quality for both states (Azhar, 2018; Azmi et al., 2022). The environmental strain on this basin has amplified concerns over sustainability, complicating an already contentious issue, a reality that underscores the urgent need for effective water governance. The water dispute has become a highly charged issue, frequently exploited during election campaigns, reflecting broader trends of political manoeuvring. Both state governments have, at various times, used the dispute as a platform to demonstrate their commitment to safeguarding their constituents' interests, framing the water issue as a matter of regional sovereignty and resource control (Abdullah & Noor, 2018). These political dynamics have made it difficult to reach a consensus, as the issue is often reframed through the lens of political agendas rather than sustainable water resources management.

The conflict's contemporary significance is emphasized by Kedah's recent demand for compensation from Penang for the use of raw water, as Kedah positions itself as the upstream state bearing the brunt of catchment maintenance (New Straits Times, 2024). Kedah contends that it shoulders the financial and environmental burdens of conserving the Ulu Muda catchment, which serves as a crucial source of water for Penang. In light of these efforts, Kedah demands an annual compensation of RM50 million from Penang, arguing that it has been subsidizing Penang's water usage without receiving any reimbursement. This demand reflects Kedah's stance that the environmental and economic costs associated with maintaining the catchment area should be equitably shared, given Penang's dependence on this resource.

Conversely, Penang asserts its right to access water from the Muda River under the principle of riparian rights under the Kedah and Penang (Alteration of Boundary) Act (1985) and the Penang Water Supply Enactment (1998). It argues that Kedah's demand lacks legal basis within the existing national legal framework, which does not explicitly

require downstream states to compensate upstream states for water usage. Penang maintains that water usage is governed by national laws, and any compensation claim should be grounded in a formal legal framework, not on arbitrary demands (The Sun, 2015).

The legal action taken by Kedah's Menteri Besar against Penang is indicative of a broader challenge in Malaysia's federal structure: the absence of a clear legal framework that governs inter-state water disputes. This has allowed such conflicts to fester, with Penang arguing that Kedah's claim is baseless, while Kedah maintains that its resources are exploited without adequate reimbursement (The Star, 2024). This dispute is illustrative of the difficulties in balancing riparian rights within a federal system where water resources fall under state jurisdiction, but water supply is regulated concurrently by both state and federal entities.

The environmental dimension of the dispute, particularly concerning the degradation of the Ulu Muda catchment, further exacerbates tensions. As Penang relies heavily on this water source, Kedah's argument that it bears the financial and ecological burden of maintaining the catchment area without adequate support from Penang gains weight (Free Malaysia Today, 2023). Forest harvesting in Ulu Muda not only threatens the immediate water supply but also endangers biodiversity and ecosystem services that support water regulation, making this an issue of national importance.

Moreover, attempts to resolve the dispute have been complicated by political opportunism. The federal and state governments have used the water dispute as campaign tools, which resulted in escalated rhetoric rather than a constructive dialogue. The polarization of the issue, fuelled by electoral considerations, has overshadowed the pressing need for a cooperative, legally grounded approach to water management (Abdullah & Noor, 2018). Such politicization has often prevented meaningful engagement with environmental experts, local stakeholders and indigenous communities, whose input is critical for sustainable water resources management.

Analysis

The constitutional framework of the Malaysian water sector

The Federal Constitution of Malaysia places water supply and services, including the sewerage services, under the Concurrent List, meaning that both federal and state governments should share responsibility in the sector (Schedule 9, FC). However, within this shared jurisdiction, a distinction is drawn between water resources and water supply and services, leading to a dual system of governance. Water resources themselves fall under state responsibility, granting individual states the authority to regulate, manage and conserve water sources within their territories. Each state has its own water enactment, which governs the use, protection, and water allocation from rivers, lakes and catchment areas. States maintain autonomy over how they manage these resources, often leading to variations in water governance across the country.

In contrast, water supply falls under federal responsibility, allowing the federal government to regulate the distribution, supply and quality of water services throughout the nation. To implement this role, the federal government has enacted the Water Services Industry Act (2006) (WSIA) and established the National Water Services Commission

(SPAN) as the central regulatory authority. WSIA provides a legal framework for regulating water supply and services, ensuring standardization, efficiency and quality control across different states. SPAN, as the regulatory body, oversees the enforcement of WSIA, monitors water service providers and ensures compliance with federal standards (Teo, 2014).

The duality of this framework creates a legal and administrative dichotomy that becomes problematic in inter-state water disputes, such as the ongoing dispute between Kedah and Penang. Kedah's claim for compensation from Penang is rooted in its control over the Ulu Muda catchment area, a crucial water source that feeds into Muda River, which Penang relies on for its water supply. Kedah's stance is that since it bears the costs of conserving the catchment area, Penang should financially contribute to this effort.

However, Penang argues that there is no explicit legal provision, either in the Federal Constitution or under any federal or state legislation, that mandates such compensation. This dispute exposes a critical gap in Malaysia's legal framework: while the federal government has the authority to regulate water supply, it lacks direct power over water resources, which remain under state jurisdiction. Consequently, there is no clear mechanism to address disputes over water resource management that transcend state boundaries.

This situation highlights the broader issue of fragmented governance, where the lack of integrated water management policies can lead to inefficiencies, conflict and challenges in achieving sustainable water resource management. The current framework fails to adequately address transboundary water challenges within a national context, leaving disputes like the Kedah-Penang case unresolved. This gap calls for a comprehensive legal framework that clarifies the roles, responsibilities, and compensation mechanisms between states, while enhancing federal oversight to ensure equitable and sustainable water resource management.

Despite the perceived legal vacuum, one thing which has not changed since the constitutional amendment is Item 11(b) of the Federal List which provides that 'water supplies, rivers & canals, *except those wholly within one State or regulated by an agreement between States concerned*: production, distribution, supply of waterpower' are under Federal jurisdiction. Technically, it is argued that if a river crosses two or more states and there is no agreement between those states, the federal government may legislate, for instance, on a Muda River basin authority. This legislative exercise has never been invoked since the federal government respects state's sovereignty to deal with the matter. Be that as it may, if Penang-Kedah water woes cannot be solved by any of the two states, the federal government should mediate and propose a river basin committee to come up with a win-win solution for both states, i.e., sharing the burden in the Ulu Muda Forest conservation, and ensuring continuous water supply for all.

The constitutional framework of the Indian water sector

This division of jurisdiction in Malaysia's Constitution, where water resources fall primarily under state jurisdiction, mirrors the approach seen in India. In India, water is also listed as a state subject under Entry 17 of the State List in the Seventh Schedule of the Indian Constitution, granting individual states control over water resources within their territories (Puthucherril, 2022). However, India's Constitution also includes Entry 56 in the Union List, which permits the central government to regulate and develop inter-state

rivers when it serves the public interest. Recognizing the potential for dispute in shared water resources, India enacted the Interstate River Water Disputes Act of 1956 (the IRWD Act), which plays a critical role in resolving disputes between states over shared water resources (Inter-state River Water Disputes Act, 1956).

The IRWD Act provides a structured, legally enforceable framework for addressing and resolving conflicts over inter-state rivers and river basins. It empowers the central government to establish independent tribunals dedicated to adjudicating specific water disputes between states. Section 3 of the Act provides that once a state government files a complaint, the central government can create a tribunal to investigate the matter, gathering evidence, assessing the needs and rights of each state, and issuing binding decisions on water allocation. These tribunal decisions have the force of law and are intended to prevent further disputes, creating a more consistent and reliable approach to inter-state water governance across India's federal system.

The Narmada Water Dispute and the Cauvery Water Dispute are prominent examples where the Act has been instrumental (Iyer, 2003). In both cases, long-standing disputes involving multiple states were addressed through tribunals, which examined historical water usage, environmental impacts, and socio-economic needs to reach equitable resolutions (Moore, 2018). While challenges in implementation and compliance remain, especially where states resist tribunal decisions, the IRWD Act has provided India with a formalized and enforceable path for managing inter-state water governance, making it an essential mechanism within India's federal framework.

To address the challenges in implementation and compliance, the Indian government has proposed the amendment to streamline the adjudication process and establish a permanent tribunal with a dedicated infrastructure (Sahu & Sai Ram, 2017). Malaysia's federal framework similarly requires a clear, structured approach to managing inter-state water disputes, especially as disputes like the Kedah-Penang case highlight the limitations of relying on individual state enactments alone. A cohesive legal framework, akin to India's approach, could enhance Malaysia's ability to manage transboundary water resources equitably and sustainably, while respecting the federated governance system.

Water related laws in Kedah and Penang

The Kedah Water Resources Enactment 2008 establishes an institutional framework for the management, use and protection of water resources in the state of Kedah. The enactment provides the *Lembaga Sumber Air Negeri Kedah* (LSANK) or the Water Resources Board, with significant powers to regulate water usage, abstraction, and diversion, ensuring that water resources are managed sustainably and equitably across the state. This framework indicates an effort to control water resources at a state level, particularly through river basin management planning, licencing of water abstraction and pollution control measures.

Under Section 22 of the enactment, there is a requirement for coordination with other states, indicating recognition of transboundary water management. This provision implies that for water resources that flow between Kedah and neighbouring states, including Penang, there is a mechanism that encourages collaboration and coordination. The legislation also empowers a River Basin Committee to oversee water management in shared river basins, which suggests potential avenues

for resolving inter-state water issues. However, the enactment lacks explicit mechanisms for resolving disputes with other states, suggesting that Kedah's approach focuses more on management within its territory than addressing trans-boundary disputes.

Meanwhile, the Water Act (1920) (Act 418), as applied to Penang, offers provisions for the control of rivers and streams, including regulations around water diversion and usage. Section 3 of the Act vests property and control of rivers within the state, giving Penang authority over its watercourses. Importantly, Section 7 prohibits any diversion of water from rivers without a licence, granting the state power to regulate water abstraction. This control is crucial when considering disputes like the Kedah-Penang case, as it directly affects how Penang can access water resources originating from outside its borders.

However, the Water Act (1920) does not specifically address inter-state water disputes or provide mechanisms for dispute resolution over shared water resources, such as Muda River. It only enables Penang to regulate water resources within its jurisdiction. It only authorizes the state Badan Kawal Selia Air (BKSA) or Water Regulatory Body within the purview of the Penang Secretary of State, to protect the state's water interest. However, Penang's spokesperson throughout this dispute was the state water operator. This highlights a lack of water diplomacy process in the state laws and constitutional framework. Ideally, the Secretary of State of Penang and Kedah should sit down together and resolve this dispute in a diplomatic manner.

On a different note, the Kedah and Penang (Alteration of Boundary) Act 1985 and the Penang Water Supply Enactment 1998 provide important legislative context for the governance and territorial jurisdiction affecting the Muda River. The Kedah and Penang (Alteration of Boundary) Act 1985 redefined the boundary between Kedah and Penang to run along the centreline of the Muda River channel, as it flowed immediately before the Act's commencement. This adjustment to the boundary is documented in certified survey plans (Gazette Plans Nos. PW 1000 to PW 1008) held by the Directors of Survey in Kedah/Perlis and Penang. The Act also specifies that if the Muda River's course naturally changes over time due to erosion or accretion, the boundary will adjust to follow the new centreline. Establishing the centreline as the boundary grants both states riparian rights to the Muda River, making unilateral water claims difficult and necessitating cooperation in river management.

Meanwhile, the Penang Water Supply Enactment 1998 provides the legal framework for water supply management within Penang. It outlines the responsibilities of the Penang Water Supply Corporation (PBAPP) and includes provisions for licencing, regulation and protection of water resources. Notably, the enactment empowers the state to gazette water catchment areas to safeguard water sources. For instance, in 2004, Penang gazetted 6288.95 hectares as water catchment areas under this enactment, demonstrating its commitment to protecting water resources (Malaysian Water Association, 2020).

The boundary redefinition under the Kedah and Penang (Alteration of Boundary) Act 1985 means that both states have legal claims to the Muda River's resources, necessitating collaborative management approaches. However, the Penang Water Supply Enactment 1998 focuses on intra-state water management and does not address inter-state water sharing or dispute resolution mechanisms. This legislative gap contributes to the ongoing

disputes, as there is no clear legal framework guiding inter-state water resource management.

International water law principles

The Helsinki Rules (1966) and the Convention on the Law of the Non-Navigational Uses of International Watercourses (United Nations, 1997), commonly known as the UN Watercourses Convention, serve as important legal frameworks for managing transboundary water resources. While neither of these instruments is directly enforceable in Malaysia, they offer foundational principles that can inform the resolution of the Kedah-Penang conflict. There are two main principles that are commonly applied under the international water law which are equitable and reasonable use, and no significant harm (Tanzi, 2020).

In 2021, the United Nations published the Practical Guide for the Development of Agreement for Transboundary Water Cooperation (UNECE, 2021). This practical guide aims to support transboundary basin countries to adopt an agreement or other arrangement for sustainable use of their shared river basin. It promotes transboundary water cooperation and encourages water diplomacy to avoid water disputes. It lays down several core building blocks and numerous supplementary building blocks that are normally included in the agreement or other arrangement for transboundary water cooperation. The core building blocks include principles such as equitable and reasonable utilization, no-harm rules, duty to cooperate especially in ecological protection, as well as duty exchange information that concerns the countries. Most importantly, the core components are the establishment of a joint body which will act as supervisor of the agreed activities and act as mediator when dispute arises. There are also many supplementary, but equally important, building blocks proposed by the practical guide.

The practical guide will let the parties decide upon the type of provision to develop within a particular building block. In addition, the parties can rely on support resources for further details, justification and explanations. Nevertheless, the final choice of building blocks will depend on specific state needs, hydrology and basin conditions. In the case of Penang, what is needed is Penang's payment for ecosystem services of the Ulu Muda Forest Reserves. Regardless of Penang's riparian right to use water from the Muda River, Kedah has lost the opportunity from forest harvesting and should be compensated for protecting the ecosystem. Should an agreement be made between Kedah and Penang, this is definitely one of the terms of the agreement. This is also an important component of the duty to co-operate.

Equitable and reasonable utilization

This principle asserts that all riparian states (or regions within a nation) have a legitimate right to utilize a shared watercourse in an equitable and reasonable manner, considering factors such as geography, hydrology, climate and the social and economic needs of each party. In the Kedah-Penang context, Penang, as a downstream user of the Muda River, emphasizes its right to access water for domestic and industrial purposes. However, Kedah, as the upstream state responsible for managing and maintaining the Ulu Muda catchment, argues for a more equitable sharing of the costs and responsibilities. The principle of equitable and reasonable use requires a balanced approach, considering

states' interests and the need to ensure a sustainable water supply. It raises critical questions about whether Penang should contribute to the conservation efforts of the catchment area, reflecting the principle that water use rights must be balanced with obligations to protect and maintain the shared resource.

No significant harm

This principle obliges upstream users not to engage in activities that would cause significant harm to downstream users. In the case of Kedah and Penang, Kedah's stance is that its efforts to protect and maintain the Ulu Muda catchment are crucial in sustaining the water supply for downstream use by Penang. Kedah contends that without adequate financial or technical support from Penang, it faces challenges in preventing potential environmental degradation that could affect the water quality and quantity available to both states. This situation raises a pertinent question of whether Penang's reliance on the water resource, without sharing in the conservation costs, constitutes a violation of the 'no significant harm' principle, as it could indirectly contribute to the degradation of the catchment.

The environmental degradation of the Ulu Muda catchment poses a direct threat to SDG 6, particularly Target 6.3 (improving water quality) and Target 6.6 (protecting and restoring water-related ecosystems; United Nations, 2015). As the upstream state, Kedah bears the financial and environmental costs of maintaining the catchment, which supports Penang's water needs. To address this, legal reforms should integrate ecosystem-based management approaches that recognize the value of preserving catchment areas and mandate compensation mechanisms for upstream states contributing to water ecosystem services. This would align Malaysia's efforts with SDG 6, ensuring sustainable management of shared water resources.

Although Malaysia has not ratified the UN Watercourses Convention, these principles provide a robust framework that can be adapted to the Malaysian context, considering that Malaysia's Federal Constitution places water resources under state jurisdiction. Therefore, adopting these principles in domestic inter-state water dispute resolution would require the establishment of a cooperative legal mechanism that recognizes both the federal and state governments' roles.

Integrated water resources management in Malaysia

IWRM has emerged as a crucial framework aimed at addressing the multifaceted challenges associated with water resource management across various sectors and state boundaries. This concept is rooted in the recognition that water resources are interconnected and that effective management requires a holistic approach that considers the entire water cycle, including surface water, groundwater and the interactions between them (Katusiime & Schütt, 2020). In Malaysia, the implementation of IWRM has been particularly significant given the country's diverse climatic conditions, varying topographies, and the increasing pressures from urbanization, industrialization and agricultural demands (Khalid et al., 2018).

Community participation is another critical aspect of IWRM that has been emphasized in various studies. Engaging local communities in water management decisions can enhance the water sustainability and foster a sense of ownership among stakeholders

(Pratiwi et al., 2019). However, in Malaysia, community involvement remains limited, often due to a lack of awareness and understanding of the importance of sustainable practices. Capacity-building programmes are essential to empower communities and promote active participation.

The integration of ecosystem services into IWRM is also gaining recognition as a critical component of sustainable water management. By considering the ecological functions of water catchments, policymakers can develop strategies that not only address human water needs but also protect and restore natural ecosystems (Cook & Spray, 2012; Khalid et al., 2018). This approach aligns with global sustainability goals and emphasizes the importance of maintaining healthy watersheds for future generations.

Moreover, the role of technology and data management in IWRM cannot be overlooked. The use of hydrological models and data analytics can provide valuable insights into water availability, quality and usage patterns, enabling more informed decision-making (Tena et al., 2019). The application of tools such as the Water Evaluation and Planning (WEAP) model can facilitate the assessment of water resources and support the development of integrated management plans that consider both current and future water demands (Yao et al., 2021).

One of the primary challenges facing IWRM in Malaysia is the fragmented institutional responsibilities that exist at both the federal and state levels. The lack of coordination among various governmental bodies complicates the effective governance of shared water resources, especially in critical catchment areas (Katusiime & Schütt, 2020; Khalid et al., 2018). The Department of Irrigation and Drainage (DID) has been regarded as the primary agency in promoting IWRM, but their efforts are hindered by the absence of a clear legal framework that mandates cooperation between states (Khalid et al., 2012). This leads to inefficiencies and disputes in shared river basins, as state governments prioritize their own interests over collaborative management efforts (Katusiime & Schütt, 2020).

The DID has developed the National Water Resources Policy (NWRP) 2012 which provides a strategic direction for water management, its effectiveness is often undermined by the lack of enforcement mechanisms and the need for greater stakeholder engagement (Khalid et al., 2012). The absence of a cohesive legal mandate to enforce cooperation between states means that IWRM often remains an aspirational framework rather than a practical tool for resolving inter-state water disputes. This situation is exacerbated by the complexities of managing water quality and quantity, particularly in areas experiencing rapid development and environmental degradation (Katusiime & Schütt, 2020; Khalid et al., 2018).

Integrated river basin management in Malaysia

The Worldwide Fund for Nature (WWF) defines IRBM as the coordinated use and management of land, water and other natural resources and activities within a river basin to ensure sustainability and productivity (Lim et al., 2022). Since rivers are the primary freshwater resource, IRBM is crucial to ensure that the river basin is managed based on its natural hydrological boundaries, rather than the administrative or political divide.

Nevertheless, the sustainability of rivers is also dependent upon sustainable management of land, agriculture, forestry and other activities that depend on rivers.

IRBM becomes a relevant concept for sustainable management of the Muda River basin as they require integration from all water-related agencies and stakeholders who rely on Muda River's sustainability, both in Kedah and Penang. Unfortunately, a proper legal framework for a river basin authority has not been achieved in Malaysia as the river administration is still based on the administrative borders and not on the river basin boundaries. In Australia, the Water Act (2007) is a specifically drafted legislation to integrate river management between four states and a federal territory in the Murray-Darling basin. Nevertheless, this model may not be easily implemented in Malaysia due to different laws on water title or water rights in Australia.

Like IWRM, IRBM requires the active participation of the stakeholders, especially the public, in river basins management. Participation will raise their environmental awareness, increase commitment to more transparent and creative decision-making and improve social learning. However, they must be involved in the planning process before making crucial decisions. In this regard, the Murray-Darling Basin Authority (MDBA) utilizes the result from the consultation process to evaluate priorities and avoid potential conflict between the upstream and downstream users (Hart et al., 2020; MacDonald & Young, 2001).

The locals know their locality well, hence conveying essential knowledge and expertise to the proposed basin plan. In one proposed basin plan, the MDBA has conducted 24 community meetings, 56 round-table discussions with community leaders, 18 bank briefings, five trade meetings and 17 conferences or workshops, all of these resulted in nearly 12,000 submissions from all stakeholders (Commonwealth of Australia, 2024). The programme continues as the government believes that participation is the key to effective IRBM.

Another reason for the slow IRBM progress in Malaysia is little acknowledgement of the role of different levels of government in water resources management. In particular, the local governments are not involved in IRBM in the country. Khalid et al. (2018) argue that they are still facing limited human and financial capacity to promote stakeholder participation in river basins management compared to Australia, the local government has the financial and legal mandate in IRBM, and IRBM works well when approached from both bottom-up and top-down governance (Khalid et al., 2018).

Recommendations

Cooperative federalism for water sustainability

The drafters of the Federal Constitution never intended that cooperative federalism cannot exist in Malaysia (Khalid & Jalil, 2018). The Reid Commission that drafted the constitution explained:

> When we say that exclusive responsibility should rest with the Federal Government or with State Government, as the case, maybe we do not intend to hamper or discourage cooperation between the State and the Federation. On the contrary, we think that close cooperation between them will promote the interests of all concerned and be of great benefit to the nation. (Reid & Federation of Malaya Constitutional Commission, 1957)

The Commission also felt that it was 'unnecessary to make any general reference to such cooperation in the Constitution' except concerning the general power of delegation and the power of the Parliament to legislate on state matters (Reid & Federation of Malaya Constitutional Commission, 1957). As such, dispute between the federal and state government, or between the states in the federation, can be avoided if all parties uphold the true spirit of cooperation within federalism.

It is timely that Kedah and Penang revisit their relationship. Cooperative federalism has also been practiced in the Murray-Darling River basin, which runs across the states of New South Wales, Victoria, Queensland, South Australia and the Australian Capital Territory (Commonwealth of Australia, 2024). Both Kedah and Penang can negotiate and cooperatively develop an implementation plan to ensure appropriate co-developments that address water sector reform and improve information flow that improves awareness and facilitates capacity building at the local government level. Thus, cooperative federalism remains a workable approach that enables governments at a different level to play some role in the water sector to resolve disputes in the inter-state river basins in Malaysia.

Adapting international norms to the national context

The integration of international water law principles into the Malaysian legal framework could enhance the country's ability to manage and resolve water disputes effectively. The Kedah Water Resources Enactment 2008 has incorporated several provisions that support sustainable water management, indirectly aligning with the no significant harm principle found in international water law. While this alignment is not explicit, it is demonstrated through measures such as the requirement for licencing of water abstraction and controls over pollution, which aim to minimize environmental impacts. Section 22 of the Enactment mandates coordination with other states, an essential provision for managing transboundary resources like the Muda River. This collaborative mandate helps to mitigate potential harm from upstream activities in Kedah that could impact downstream users in Penang.

Such provision corresponds with the principles of IWRM and IRBM, which both advocate for holistic, collaborative management across political boundaries. However, this Enactment lacks explicit mechanisms for inter-state compensation or frameworks for cooperative management, which limits its alignment with international water law principles. Establishing a bilateral agreement between Kedah and Penang could bridge these gaps by incorporating compensation mechanisms and cooperative management practices. Such an agreement, potentially backed by an inter-state water authority to handle negotiations, monitor water usage and oversee sustainable water resource management, would enhance transboundary water governance, mirroring successful models in other international river basins.

Additionally, drawing from successful models such as the Indus Waters Treaty (1960) between India and Pakistan or the Murray-Darling Basin Agreement in Australia, Malaysia could develop its own legal mechanism for managing inter-state water disputes. This framework would involve a blend of federal oversight, state autonomy and adherence to the principles of equitable and reasonable use and no significant harm, thereby fostering a more collaborative and sustainable approach to water resource management.

Promoting transboundary water cooperation

The existing legal framework for resolving inter-state water disputes in Malaysia is fraught with significant limitations and gaps that hinder effective dispute resolution and sustainable water resource management. Divisions between water resources management and water supply management often lead to inconsistencies in policy implementation, complicating efforts to address inter-state disputes like the Kedah-Penang dispute. This contrasts with the 'joint management' and 'coordinated governance' elements in Table 1 regarding Supplementary Building Blocks for Transboundary Water Cooperation, which stress unified oversight in managing shared resources. Without a cohesive framework to bridge federal and state roles, the constitution lacks the provisions necessary for a consistent, integrated approach as seen in international water cooperation models.

This absence of a structured dispute resolution process leaves room for prolonged negotiations, political manoeuvring and inefficiencies that fuel ongoing tensions. While the Kedah enactment encourages coordination with other states, it falls short of establishing binding procedures or dispute resolution mechanisms. Similarly, the Water Act (1920) 's emphasis on state-level control without provisions for inter-state negotiation contributes to potential disputes over shared resources. It is thus recommended that the state governments in Malaysia amend their state water resources enactments by referring to the Supplementary Building Blocks for Transboundary Water Cooperation. In particular, it highlights 'dispute resolution mechanisms' and 'joint monitoring and assessment' as critical components for effective governance, neither of which are well-defined in the state or the federal laws. Without a dedicated legal instrument that empowers federal

Table 1. Supplementary building blocks for transboundary water cooperation.

Supplementary building blocks	Components
General rights and obligations	Ecosystem protection
	Human rights to drinking water and sanitation
Principles	Precautionary principle
	Polluter pay principle
	Sustainability principle
Sectoral and intersectoral issues	Navigation
	Energy
	Agriculture
	Climate change
	Spiritual aspects
Water management and protection	Hydraulic facilities and infrastructure
	Protection of marine environment
	Water allocation and flow regime
	Emergency and disaster management
	IWRM/ IRBM Plans
	Groundwater
	Water pollution
Procedural issues	Public participation
	Stakeholder involvement
	Notification & consultation
	Joint monitoring & assessment
	Strategic & environmental impact assessment
Implementation	Financing
	Compliance mechanism
Final provisions	Amendments and supplementary institution
	Relationship with other instruments

Source: Modified from UNECE (2021).

authorities to intervene or facilitate negotiations, disputes are left unresolved, with each state prioritizing its interests over collective water resource management.

As a starting point, Kedah state government could build upon section 22 (read with section 20 and Part IV in its entirety) of the Kedah Water Resources Enactment 2008 to foster more active joint collaboration with neighbouring states, such as Penang. It offers a practical step towards alleviating tensions over shared resources. This interim approach could serve as a foundation for further engagement and cooperation, paving the way for more comprehensive reforms, such as the establishment of a legally binding statutory instrument for inter-state water dispute resolution.

Ensuring effective integrated water resources management implementation

Although Malaysia has adopted IWRM as part of its water governance strategy, the framework remains largely aspirational and conceptual rather than enforceable. There is a lack of binding legal instruments or enforcement mechanisms to ensure that states adhere to IWRM principles, particularly in the context of inter-state water disputes. As a result, states often operate in silos, with limited cooperation or coordination in managing shared water resources. This undermines the effectiveness of IWRM in promoting equitable, efficient and sustainable water resource management, as states are not legally obligated to engage in collaborative practices.

The 'IWRM/IRBM plans' and 'compliance mechanisms' as provided under Supplementary Building Blocks are essential for realizing sustainable management objectives, yet these components are not mandatory under the current legal framework. In addition, Table 1 focuses on 'procedural issues' such as public participation and stakeholder involvement as they are crucial for effective IWRM implementation. Without these components in place, the current legal framework misses out on opportunities to foster a more inclusive and collaborative approach.

Since IWRM requires an inter-agency collaboration and stakeholder participation, this can partly be achieved through the National Development Planning Committee and the National Physical Planning Council. The relationship between sustainable development policies, the management of natural resources, and the law that governs these resources is very complex. Creating a more integrated and coherent structure in managing water resources is a challenge to be addressed to all stakeholders in the water industry. Although IWRM should be the way forward, the existing legal framework should be amended to ensure successful implementation of IWRM. Thus, a specific study is needed to determine the best mechanism to implement IWRM in Malaysia and resolve overlapping powers amongst water departments.

Effective transboundary governance frameworks

The absence of formalized compensation mechanisms for upstream states further exacerbates the limitations of the current legal framework. Upstream states, like Kedah, often bear the environmental and financial costs of maintaining water catchment areas without receiving adequate compensation from downstream users. Effective transboundary governance frameworks typically include provisions for recognizing and rewarding ecosystem services, ensuring that states contributing to water conservation are compensated.

Mandatory payment for ecosystem services provided by upstream states will encourage states to invest in the conservation of water resources.

To address the challenges of inter-state water disputes in Malaysia, several critical legal and institutional reforms are necessary. While Item 11(b) of the Federal List provides the federal government with the authority to legislate on matters related to shared water supplies and rivers crossing state boundaries, it has not been actively invoked, and the provision lacks detailed mechanisms for resolving disputes. Therefore, a specific legislation to establish a clearer and more structured framework for managing inter-state water disputes is needed. This empowers the federal government to mediate and resolve disputes between states, ensuring a legally binding approach that includes provisions for compensation, conservation responsibilities and equitable resource sharing. Formalizing these processes will enable Malaysia to more effectively address transboundary water challenges, such as the Kedah-Penang dispute, while promoting sustainable and cooperative water resource management.

In the light of climate change impacts on the water sector, the federal government should consider establishing a shared river basin law to ensure sustainable management of shared river basins, not only for the Muda River, but for 14 more inter-state river basins as listed in Table 2.

A shared river basin law would create a committee to address the specific needs of the shared basin while maintaining a consistent, scalable framework applicable to any future inter-state river disputes. Its functions would encompass the regulation and sustainable management of all transboundary water resources, with authority over critical areas including water resource allocation, conservation initiatives and dispute resolution. In cases like the Muda River basin, the committee would oversee equitable sharing arrangements between upstream and downstream states and ensure conservation efforts are coordinated and effective. Furthermore, it would establish a formal compensation mechanism to address costs incurred by upstream states, such as those related to ecosystem services provided by the Ulu Muda catchment area in Kedah. This will align Malaysia's practices with international water law principles.

A shared river basin committee would serve as a centralized agency with the legal mandate to resolve disputes between states. It would facilitate negotiations between

Table 2. Shared basin states in Peninsular Malaysia.

No.	River	Shared basin states	km^2
1	River Perlis	Perlis/Kedah	724.398
2	River Perai	Pulau Pinang/Kedah	447.824
3	River Jawi	Pulau Pinang/Kedah	231.031
4	River Kerian	Pulau Pinang/Kedah/Perak	1,420.234
5	River Muda	Pulau Pinang/Kedah	4,150.397
6	River Bernam	Perak/Selangor	2,836.334
7	River Langat	Selangor/Negeri Sembilan	2,347.883
8	River Sepang	Selangor/Negeri Sembilan	101,933
9	River Linggi	Negeri Sembilan/Melaka	1,297.668
10	River Melaka	Negeri Sembilan/Melaka	614.575
11	River Kesang	Melaka/Johor/Negeri Sembilan	658.263
12	River Muar	Johor/Pahang/Melaka/Negeri Sembilan	6,137.801
13	Sg Endau	Johor/Pahang	4,739.060
14	Sg Pahang	Pahang/Negeri Sembilan	28,682.247
15	Sg Semerak	Kelantan/Terengganu	500.498

Source: Modified from Department of Irrigation and Drainage (2021).

disputing parties, but, when necessary, would have the power to impose binding decisions, ensuring that water-related disputes are resolved in a timely and equitable manner. This dispute resolution function would reduce reliance on political interventions and foster a cooperative approach to water governance, strengthening Malaysia's framework for inter-state resource management. It will create a structured, flexible framework capable of adapting to any shared basin dispute, from the Muda River basin to future transboundary water challenges.

Finally, in conjunction with the recommendation for the establishment of the committee, a formal Kedah-Penang Water Sharing Agreement should be negotiated, ensuring that both states have a clear, legally binding framework for water allocation, conservation responsibilities and compensation. This agreement should mandate public and stakeholder engagement, involving local communities, agricultural interests, environmental groups and industry representatives from both states. This inclusive approach will ensure that all voices are heard, fostering transparency and trust between stakeholders. The agreement should include periodic reviews and consultations to adapt to changing conditions, such as population growth or climate change, ensuring a sustainable and flexible approach to managing the shared water resources.

Conclusion

The Kedah-Penang water dispute serves as a compelling illustration of the broader challenges facing Malaysia's legal framework in managing inter-state water disputes. The current dichotomy between federal and state jurisdictions, as outlined in the Federal Constitution, has created legal ambiguities that complicate the resolution of such disputes. While states retain control over water resources, the regulation of water supplies falls under federal oversight, leading to a fragmented governance structure that lacks the necessary mechanisms for addressing inter-state water disputes comprehensively. This fragmentation is further compounded by the absence of explicit legal provisions for compensating upstream states, as seen in Kedah's demand for compensation from Penang. Drawing on insights from international water law principles and the shortcomings of Malaysia's implementation of IWRM, this paper highlights the need for a more integrated and legally binding approach to water governance. Establishing a clear legal framework that empowers federal authorities to mediate inter-state disputes, along with formalizing compensation mechanisms for upstream states, would be a crucial step in addressing these challenges. Additionally, strengthening the enforcement of IWRM and IRBM principles through binding legal instruments and establishing a dedicated federal mediation body would enhance inter-state cooperation and ensure sustainable water resource management.

The findings in this paper advocate for the establishment of river basin laws to regulate and manage transboundary water issues across Malaysia. It will provide a centralized, legally enforceable structure for addressing inter-state water disputes and overseeing sustainable water resource management. It will incorporate compensation frameworks for ecosystem services, aligning with international water law principles and ensuring that states bearing the cost of water conservation are adequately supported. It balances the interests of both upstream and downstream states and ensures a more equitable, efficient and sustainable approach to managing shared water resources. This approach would not only address current issues, such as the Kedah-Penang dispute, but also set a precedent for effectively managing

future inter-state water challenges. In doing so, Malaysia would be positioned to meet Sustainable Development Goal 6 (SDG 6) on clean water access and sustainability. The suggested framework offers a model that can be adapted by other countries with federal systems facing similar inter-state water challenges, providing a path for international jurisdictions to address and resolve water disputes within a structured, cooperative framework.

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ORCID

Muhammad Nazrul Abd Rani http://orcid.org/0009-0003-2580-0856
Rasyikah Md Khalid http://orcid.org/0000-0002-6328-5520

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