

## APPLYING GOOD GOVERNANCE PRACTICE IN THE IMPLEMENTATION OF INTEGRATED WATER RESOURCE MANAGEMENT: ANALYSING THE RELATIONSHIP

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**Abstract:** Over the last 20 years, Integrated Water Resource Management (IWRM) has become the most prominent approach in settling various types of water issues amongst the various countries in the world. However, its implementation is still doubted even though various policies and programmes have been introduced. Previous studies also claimed that Malaysia is inclined towards a slow implementation of IWRM as the country is plagued by poor governance which is recognised as one of the barriers to proper implementation. Unfortunately, these studies, they do not provide sufficient empirical evidence to establish a relationship between IWRM and good governance practice in Malaysia. This study examined the role of these variables and identified the significant relationship that potentially contributes to the effectiveness of the IWRM implementation. The primary data was obtained from seven states involved in eight IWRM Best Management Practices (BMP) projects, where 212 respondents were selected using Purposive Stratified Sampling. A chi-square test and descriptive analysis were adopted in analysing the collected data to determine the relationships. The outcome indicated that seven out of the 14 IWRM elements and 17 out of 39 good governance elements were appropriate and revealed a significant relationship that improved IWRM implementation, which can be used as a reference to support the National Water Resources Policy.

Keywords: Integrated water resource management, good governance, best management practices.

### Introduction

Global water issues have received increased attention in every region of the world, with regards to the effects of climate change, urbanisation, and natural disasters. Several impactful water security issues have already become highly prevalent. These encompass issues regarding water quality, quantity, and reliability, the equitable access to and environmental sustainability of water resources (Schimpf & Cude, 2020). Recent research predicted that more than 390 million people will be exposed to “water stress” by 2050 compared to 2010. This could be even worse and may threaten the progress of human health and socioeconomic development (Marsh & McLennan Companies & Zurich Insurance Group, 2019), particularly when the population increases, urbanisation growth spikes, the climate changes, and water infrastructure degrades.

In search of the solutions, the United Nations (UN) recommended that all countries address the problems outlined above through the adoption of an Integrated Water Resource Management (IWRM) approach.

Since 1977 at Mar del Plata UN-Water Conference, IWRM mainly focused on laying the foundations for its principles (United Nations, 1977). These included the regulation and management of water supply, demand, quality, and risks, which required a definition of the actions to strengthen the affiliated institutions and ensure the governability of the system.

In 1992, following the timetable of IWRM development at the Rio Earth Summit Conference, the delegates concluded several documents, such as Agenda 21, and Chapter 18. At this stage, the IWRM was emphasised formalising its development and management (United Nations, 1992).

Then, in 2002, The Johannesburg Declaration on Sustainable Development started to focus on its plan of implementation. As this progressed, the aims were to establish national IWRM initiatives, and water efficiency plans by 2005 (United Nations, 2002).

Moving to the Declaration of the Future We Want in the UN Conference on Sustainable Development in 2012, as the progress implementation was slow in most countries, there was an urgency to reaffirm commitments towards developing IWRM initiatives. Then, the progress of IWRM moved forwards with Agenda 2030 and the Sustainable Development Goals (SDGs), which were adopted by all members of the United Nations in 2015.

In terms of the IWRM implementation, countries will make an effort to achieve the 6.5 target by 2030. With the increase in water scarcity and pollution, IWRM implementation needs to accelerate its goals and to realise the 2030 Agenda much sooner (United Nations, 2015). Figure 1 shows the chronology of IWRM developments globally.

To some researchers like Shah and Koppen (2006), IWRM has become over-reliant on top-down reforms and heavily focused on idealised goals. While Biswas (2004) critiques the application of IWRM as not being able to efficiently manage the world’s water policies and lacking in terms of delivering a concrete solution. However, Mark and Torkil (2018) were more positive stating that adopting IWRM in SDGs and recognising its potential in the latest global agenda to mobilise synergies towards achieving targets shows that the demands and

improvements with IWRM initiatives are now much more prominent than in the past.

The approaches used to manage and govern water resources and services have seen a significant shift over the years. This is due to the increasing relevance of the concepts of sustainable development and resilience. Thus, in implementing the IWRM concepts, good governance is essential to ensure that stakeholders’ decisions and actions are transparent.

In other words, IWRM assists in strengthening the governance structure so that the decision-making process is adequate to overcome the needs due to the current water issues.

Thus, water governance has emerged as an essential topic in the international arena and has been acknowledged as a crucial factor ensuring adequate and sustained progress towards achieving SDG 6. Hitherto, three of the eight targets for SDG 6 focused on improving water governance (UNEP, 2018; Di Baldassarre *et al.*, 2019). According to Global Water Partnership (GWP) (2015), the strength of political, legal, and economic institutions determines a country’s ability to manage water resources effectively. The higher the level of institutionalisation and governance, the more water security is likely to be increased.

With this in mind Malaysia has emphasised three principles in their National Water Resources Policy, which are water security, sustainability, and governance (National Water Resource Policy, 2012).

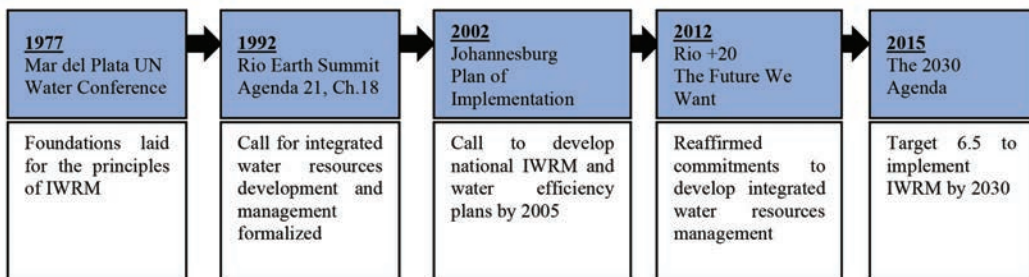


Figure 1: Key global agreement on integrated water resource management (IWRM) development

As water resources management is a complex thing, if not managed well, it can adversely impact the sustainability of various sectors and hamper the country's development. Through the conceptual model developed by Zargapour and Nourzad (2010), it was found that the establishment of a governance structure is the main element of 14 other elements that can ensure that the IWRM implementation can be carried out effectively. This model also concluded that the water governance of IWRM is one of the critical elements in ensuring water security.

The attributes of governance have also evolved from a state-centric and hierarchical problem-solving approach of "good" governance to that of promoting openness, efficiency, law, justice, transparency, accountability, broader participation, decentralisation and deliberation (Graham *et al.*, 2003). Poor water governance and inequitable resource distribution have increasingly been recognised as significant contributors to this crisis (Porcher & Saussier, 2019). Numerous public, private, and societal actors have declared achieving good water governance as the a top priority for the WASH an acronym that stands for "water, sanitation and hygiene" sector (USAID, 2017).

Moreover, UN Water (2018) stated, that three of the eight targets for SDG 6 focus on improving governance. Thus, it is proven that governance is a prerequisite for improving water management (Pahl-Wostl, 2017) since it features prominently in SDGs. Although there is a conceptual overlap between water governance and water insecurity, as well as theorised pathways linking improved governance to improved water security, the two are sometimes conflated (Klumper *et al.*, 2017). Besides, as the engineering-driven and technology-driven management approaches are currently being scrutinised, more integrated approaches emphasising good governance have emerged (World Water Assessment Programme, 2006).

As effective IWRM policy is essential for planning, implementing, and monitoring the country's sustainability of water resources. Therefore, accomplishing good water governance cannot be undertaken promptly using blueprints from outside any given country or region. It needs to be developed in suitable local conditions to solve the water resources issues critically and precisely.

As far as a critical literature review is concerned, there is a comprehensive agreement among researchers about the lack of available literature on the relationship between IWRM initiatives and good governance. The literature does not fully explain the barriers hence requires further investigation to fill in the gap by empirically exploring the relationship and significance of good governance practice to adopt in IWRM implementation (Suhaily & Zainudin, 2010). The realisation of IWRM principles depends very much on effective water governance, where weak governance can lead to government failure, market failures and an overall system failure (Khalid *et al.*, 2010). However, the relationship between good governance practices in enhance IWRM implementation progress must be explored first.

Therefore, this paper attempts to identify the current progress of IWRM initiatives and highlight several barriers to its implementation and to explore the relationship between good governance practice towards the IWRM implementation. Besides, the study was undertaken to emphasise the significance of good governance practices in assessing the progress IWRM initiatives and its implementation, as well as enhancing the sustainability of Malaysia's water resources. As poor governance negatively impacts water resource management, this paper tried to promote the relationship's significance between good governance and IWRM for assessment of the progress implementation as a work performance guideline especially for the various stakeholders involved. This is an alternative way to monitor the progress of the IWRM implementation.

### ***IWRM Implementation Progress Globally***

IWRM has been globally acknowledged as a leading approach in water management among water professionals for the past two decades (Acheamponga *et al.*, 2016; Budryte *et al.*, 2018). Currently, 172 countries are implementing IWRM, and progress is taking place at all levels; national, local, transboundary, basin and aquifer that makes the status vary enormously.

However, the implementation of IWRM processes remains undoubted (Sukereman *et al.*, 2015). Previous studies claimed the success of its implementation has been limited (Biswas, 2004; Saravanan *et al.*, 2009; Samekto, 2015). Critics portray IWRM initiatives as a “nirvana concept” focusing on general blueprints and panaceas, failing to take the local context into account when it comes to its practical implementation (Halbe *et al.*, 2013).

At the same time, Acheamponga *et al.* (2016) argues that there is still no authorised and standardised framework available to be used by the stakeholders involved to assess the efficiency and effectiveness of IWRM implementation progress. Nevertheless, referring to Figure 2 and Table 1, more than 80% of the countries have laid solid foundations to achieve at least medium-low levels of IWRM implementation.

To date, the data obtained in Table 1 (UNEP, 2018) indicates that, 19% of countries at the lower end have started developing IWRM

approaches.

However, the lower progress countries need to prioritise activities that will significantly impact the national context.

At the same time, 62% of the countries in the mid-range of progress have generally implemented several elements of IWRM in their long-term programmes.

However, they need to focus on implementation, especially in collaborative governance, which expands coverage and stakeholder engagement. Finally, the top 19% of countries are generally achieving IWRM policy objectives and need to remain focused to consolidate and strengthen gains.

However, UNEP (2018) claims that if accelerated progress has not been made in most regions to achieve the target, it is expected that most countries will not meet the target by 2030 keeping to the current rate of implementation.

### ***Example of Good IWRM Implementation Progress in Selected Countries***

In determining a good example of IWRM implementation, several countries have been identified from an assessment made by United Nations in 2018 (as shown in Figure 2). Those countries have a very high level of IWRM progress implementation with a score of 100 for Singapore and 98 for Japan.

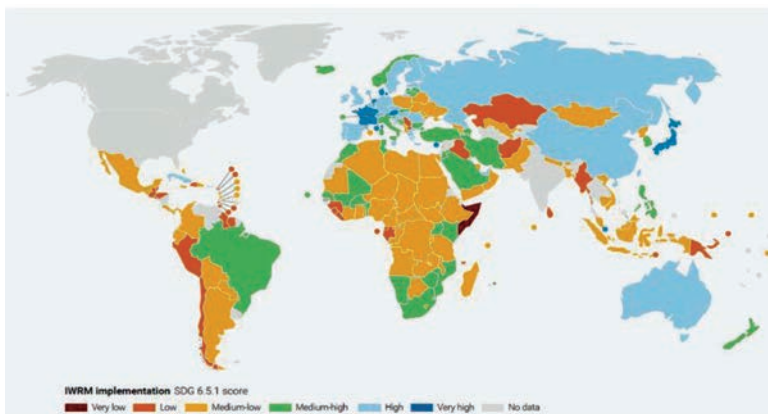


Figure 2: Countries mapping on IWRM implementation

Table 1: Score range of countries' IWRM implementation progress

Percent of Countries at Each Implementation Level		Score Range	Baseline	Towards 2030
4	Very high	91-100	Achieving policy objectives for IWRM: 19%	Countries in this category are likely to reach the global target, or have already done so, but will need to remain focused to consolidate and strengthen gains.
15	High	71-90		
21	Medium-high	51-70	Implementing most elements of IWRM in long-term programs: 21%	Countries in this category are potentially able to reach the target, but sustained efforts need to focus on 2030 targets.
41	Medium-low	31-50	Have institutionalized most elements of IWRM: 41%	Countries in these three lowest categories (60% of countries) are unlikely to meet the global target unless progress significantly accelerates.
19	Low	11-30	Have started	Countries in the three lowest categories should aim to set national targets based on the country context.
<1	Very low	0-10	developing set national targets based on the country context. Elements of IWRM: 19%	

### *Singapore (Jensen & Nair, 2019)*

Singapore is a city-state with a territory of 700 square kilometers. Even though the rainfall per year (2,400 mm) is abundant, it faces severe water availability constraints due to the absence of primary natural water storage spaces, limited land area and a growing population.

However, the success of the IWRM programme can be attributed to the effort of various sectors, which range from the political will and the infrastructure provided by the government, the collective commitment of the community, technological expertise, and the innovation of the private sector. In order to protect their water resources, Singapore has a very stringent water pollution control programme as the government has tackled the pollution issues at the source.

As a result, despite more than 30 years of urbanisation and industrialisation, Singapore is still able to turn half of its limited area of 660 sq km into water catchments.

Singapore has also leveraged rapid membrane technological advances in utilising desalinated and reclaimed water (NEWater). To increase the water supply, Singapore has proceeded with the rapid implementation of an enormous capital investment. The NEWater plants were first commissioned in 2003 (PUB, 2016), and in 2017, they were expanded to 758,000 m<sup>3</sup>/d. The investment in the re-use treatment capacity has been complemented through deep tunnel sewerage, which was expected to be completed in 2025.

Other than that, by minimizing the wastage in the water supply system, Singapore has achieved a low unaccounted-for-water rate by implementing leakage control and accurate metering policies, proper accounting for water used and strict legislation.

In addition, a community-driven programme called Water Efficient Homes also helps Singapore households conserve water through water-saving devices that can be easily fitted in the taps.

### **Japan (Yumiko, 2016)**

Japan's average annual precipitation stands at 1,690 mm, about twice the world average (810 mm). On the other hand, Japan's potential water resources per capita are 3,200 mm<sup>3</sup> per year, less than half the world average, about 8,400 mm<sup>3</sup>. There is a tendency for potential water resources to decrease in years of drought due to the expansion of the gap in rainfall between years of low precipitation and high precipitation.

There are no such difficulties in ensuring water efficiency in Japan as various historical measures have been taken to use water effectively. However, the success of the IWRM programme can be attributed to the commitment of achieving effective water resource management through financing for both initial investments and ongoing costs.

The government of Japan is highly committed to funding and fully covering most of IWRM activity dealing with water resources development and management. In terms of allocation and utilisation of budget, the report from the United Nations stated that Japan had used the budget for the completed and reviewed of IWRM planning programmes. In terms of technologies for water resources management, Japan has developed various technologies to efficiently utilise available water resources. They have built the foundations for social, and economic growth in other countries. Examples of advanced water-related technology in Japan include the use of leakage prevention technology, reuse of industrial water, desalination technologies, and advanced waterworks using ozonation processes and biological activated carbon absorption treatments.

Authorities in Japan have the capacity to lead IWRM plan revision. 29 local governments have declared to protect water, human, and biodiversity's circulation and committed to "Kiso Three Rivers Basin Municipalities

Summit" every year to protect water resources development. Through the effective collaboration of authorities in mobilising river protection among the locals, public participation is also well received as more than 50,000 supporters have carried out IWRM processes to conserve the water environment.

### **Progress and Challenges of IWRM Implementation in Malaysia**

Global Water Partnership has stated that Malaysia is one of the committed countries and has taken several initiatives to implement the IWRM plan (Donoso & Cancino, 2010). Furthermore, Malaysia has been actively practicing IWRM since 2002 and continuously highlights its major achievements as stated in the 8<sup>th</sup> Malaysia Plan (8MP, 2001-2005), 9<sup>th</sup> Malaysia Plan (9MP, 2006-2010), the 3<sup>rd</sup> Outline Perspective Plan (OPP3, 2001-2010), National Water Resource Policy (2012), 10<sup>th</sup> Malaysia Plan (10MP, 2011-2015) and 11<sup>th</sup> Malaysia Plan (11MP, 2016-2020).

Additionally, IWRM has been promoted by many organisations and included in 20 pilot projects, of which 11 were acknowledged as best management practices projects in Malaysia. Many policies, plans, and programmes have also been carried out to ensure that the IWRM approach can be implemented effectively not only by the government, but also by the private sector and non-government organisations.

Table 2 shows the IWRM implementation in Malaysia by categorising the progress into eleven component statuses (Eight Malaysia Plan (2001-2005); Ninth Malaysia Plan (2006-2010); Tenth Malaysia Plan (2011-2015); National Water Resources Policy, (2012); Sukereman & Suratman, 2014; Abdullah *et al.*, 2016; Eleventh Malaysia Plan (2016-2020); Md Khalid, 2018) Malaysia have adopt Integrated Water Resource Management (IWRM).

Table 2: Progress of IWRM Implementation in Malaysia

No.	Status of IWRM	Progress Implementation
1	National Water Resource Policy that adopts the IWRM approach	National Water Resource Policy (NWRP) was established in 2012. The policy focuses on better coordination among water related agencies and stresses that “the security and sustainability of water resources shall be made a national priority to ensure adequate and safe water for all, through sustainable use, conservation and effective management of water resources enabled by a mechanism of shared partnership involving all stakeholders.”
2	Water legislations that incorporate the principles of IWRM	<p>Water Allocation Enactment 1920 is not suitable to be applied to the current time frame and environment after it was compared to the current allocation requirements and requires further study. As a reform, the Water Enactment has been launched to strengthen the management of water resources in each state (except Perlis and Kuala Lumpur).</p> <ul style="list-style-type: none"> <li>• Terengganu Water Resources Enactment 1938</li> <li>• Melaka Waters Act 1920 (Revised 1989)</li> <li>• Negeri Sembilan Water Act 1930 (Revised 1989)</li> <li>• Kelantan Water Enactment 1935</li> <li>• Sarawak Water Ordinance 1994</li> <li>• Sabah Water Resources Enactment 1998</li> <li>• Sabah Water Supply Enactment 2003</li> <li>• Selangor Water Management Enactment 1999 (LUAS)</li> <li>• Pahang Water Resources Enactment 2007</li> <li>• Perlis Waters Enactment 2011</li> <li>• Johor Water Enactment 2014</li> <li>• Kedah Water Resources (Amendment) Enactment 2014</li> </ul>
3	Establishment of IWRM Organisation at the federal level	<p>There is still no department or organisation for water resources at the federal level. However, the Department of Irrigation and Drainage (DID) is seen as the primary water agency in Malaysia. DID remains a technical agency without legislative authority in the management of rivers and other water resources.</p> <p>Suruhanjaya Perkhidmatan Air Negara (SPAN) was established following the NWSIRI and the 2006 constitutional amendment to enforce the new Water Services Industry Act 2006 (WSIA 2006). SPAN will only have this power if the state government agrees to migrate to SPAN’s regime, currently has nine out of the 12 states have migrated to the licensing regime under the Water Service Industry Act 2006 (Act 655).</p> <p>The remaining three states (Perlis, Selangor and FT of Labuan) are operating under SPAN’s authorisation. However, there is still no organisation that entirely focuses on managing IWRM itself at the federal level.</p>

4	Implementation of IWRM Organisation at the state level	<p>Two states in Peninsular Malaysia have set up their water management authority.</p> <p>(i) Selangor Water Management Authority Enactment (SWMAE) 1999 established the Selangor Water Management Authority or locally known as Lembaga Urus Air Selangor (LUAS).</p> <p>(ii) Kedah Water Resources Enactment 2008 established the Kedah Water Resources Authority (KWRE) or Lembaga Sumber Air Negeri Kedah (LSAN).</p> <p>The implementation of IWRM by State Management Authority is not oriented to the progress despite its focus on water protection and pollution control.</p> <p>The specific provisions in the SPAN Act, 2006 seem redundant with the state water authorities' responsibilities. As both SPAN and LUAS have the power to enforce water regulations, these may lead to some overlap with LUAS' functions as well as further conflicts.</p>
5	IWRM management instrument	<p>(a) River Basin Decision Support System (RB-DSS)</p> <p>(b) IWRM Modelling Approach</p> <p>(c) IWRM Toolbox</p> <p>(d) The Urban Governance initiative (TUGI) Report Cards (RCs)</p> <p>(e) Collaborative Decision Making (CDM)</p>
6	Government allocation and expenses on IWRM	<p>Government funding on IWRM implementation has been allocated in each Malaysian Plan, focusing mainly on the 9<sup>th</sup> Malaysian Plan. It is estimated that RM500 million per Malaysian Plan will be explicitly allocated into ongoing IWRM-water research activities from the 11<sup>th</sup> Malaysian Plan until the 13<sup>th</sup> Malaysian Plan.</p> <p>However, the funding has not been specifically allocated on the aspect of enhancing the capabilities of enforcement bodies to monitor the progress implementation.</p>
7	IWRM management performance at the basin level	<p>There are 11 IWRM Best Management Practice Projects (2009-2012) in nine states of Malaysia encompassing the states of Melaka, Negeri Sembilan, Selangor, Kuala Lumpur, Pahang, Kelantan, Penang, Sabah and Sarawak. However, the recognition of best management practices for this IWRM project was not continued.</p>
8	Stakeholder participation and support systems from public groups	<p>Capacity Building through MyWP collaboration in 2010. Establishment of My Cap in the Global Environment Centre and the Open University of Malaysia. Awareness programmes and campaigns have been launched by government agencies and NGOs such as <i>Forum Suara Air Saya</i>, <i>Minggu Alam Sekitar</i> Malaysia.</p>
9	Education and training programs	<p>University Terbuka Malaysia (Open University of Malaysia) is the only institution in Malaysia that has offered Master of Science courses in IWRM to the public. However, this course was closed in 2011 due to the low response received for the programme.</p> <p>Establishment of Water Research and Innovation Cluster in the 11<sup>th</sup> Malaysian Plan, which was led by NAHRIM with the target completion in the 13<sup>th</sup> Malaysia Plan, focuses on:</p> <p>(i) Set up a dedicated Water Research Centre</p> <p>(ii) Establish Water Data Centre</p> <p>(iii) Develop Water Innovation and Industry Cluster</p> <p>(iv) Develop centres of Water Excellence in local academia</p> <p>(v) Water research based on 21 themes and 96 research topics</p>



10	Administrative reform in the federation	Reorganisation and reshuffling of the ministry that eventually led to the formation of the Natural Resources and Environment Ministry and the Energy, Green Technology and Water Ministry.
11	Assessment of IWRM level of progress	<p>Currently, there is no framework to evaluate the implementation of IWRM for each state in Malaysia. However, there are some assessments related to water resources such as assessing river water quality status through the Water Quality Index (WQA), which adopts six parameters and an environmental impact assessment.</p> <p>Acknowledging the shortcomings in the current water research governance, two options are recommended by the government specifically to enhance the IWRM implementation with the establishment of Water Research Governance Options encompassing:</p> <ul style="list-style-type: none"> <li>(i) Water Research and Development Centre (WRDC) proposed as a statutory body to act as a clearinghouse and one-stop centre, to deal with all aspects of water R&amp;D in the country.</li> <li>(ii) Water Research Consortium (WRC) to be formed for the existing water related public and private sector ROs and research centres at the local universities, and led by NAHRIM, to facilitate coordinated water-related research to meet the multi-faceted needs of the water sector in Malaysia.</li> </ul>

Despite having positive performances through several achievements for over 20 years in the country, there are some implementation issues being highlighted in Table 2, i.e., to see whether the progress achieved the Goal of Six in SDG. This effectiveness of this approach in achieving IWRM goals and objectives was not apparent as the progress was slow due to various challenges in IWRM implementation.

According to the Sustainable Development Goal 6 Synthesis Report 2018 on Water and Sanitation, 38% of the countries reported at least medium-high IWRM implementation in 2017/2018 (UNEP, 2018), while, Malaysia was one of the countries in the “medium-low” category for IWRM implementation progress.

One of the barriers that was highlighted in the report was that Malaysia faced limitations in obtaining funding. It experiences shortages of human capacity for the planning or implementation of IWRM measures, especially at the sub-national level. This in turn affects the status of water management structures and impedes its ability to plan, assess, and monitor IWRM activities.

It has been proven in numerous studies that Malaysia has various water legislations

and more than a few policies and programmes aimed at ensuring the sustainability of water resources and management.

Nevertheless, water resources management initiatives still have trouble with the implications of the rapid urbanisation and industrialisation, which is exacerbated by climate changes and an increasing number of polluted rivers, making some traditional approaches to planning and managing water resources ineffective and in need of urgent appraisal.

Based on the review, the study revealed that the lack of enforcement could be a significant factor that challenges the implementation of IWRM procedures. Since effective enforcement has been seen as a critical factor to the success of IWRM, it is crucial to identify some measures that can reduce barriers to implementation and then revisit the issues.

Other challenges that slow the implementation of IWRM measures, as stated by other research papers, include the lack of practicable IWRM instruments that suit different local conditions (Elfithri *et al.*, 2012), the lack of collaboration among water resource management players and the overlap of

authorities in managing water resources (Saimy & Yusof, 2013).

To sum up, it could be stated that all the progress in Table 2 might be related to the lack of continuous monitoring activities in an effective, or efficient, manner without any good governance, while implementing the IWRM.

Costa Rica has legal, technical, and economic mechanisms to conduct groundwater monitoring, improve water use efficiency, and control water pollution. However, national IWRM policies and plans have not yet been implemented. According to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) report (2017), Latin America is a water resource-rich country where 93% of its population has access to drinking water and 79% has access to sanitation.

However, due to poor governance in water resources management, only 13% of the water resources can be treated. This has left 75 million people without access to clean water, while 116 million people lack sanitation services. As a result, 34 children out of every thousand people die each year of waterborne diseases.

These examples show that water managers can maintain and advance good water management practices under existing legal and institutional systems. Thus, the Malaysian Government and external support agencies should learn from this experience and boost implementation efforts to ensure that there is accelerated progress and positive outcomes.

Attention should be given towards building on IWRM monitoring and reporting systems and addressing barriers to progress. Thus, it is particularly important to tighten the linkages between enforcement through good governance practices to monitor IWRM progress and make sure reforms are designed and implemented in the most effective and efficient ways.

## Methodology

The stages of this research are presented in Figure 3 which include preliminary studies, data

collection, analysis, findings, discussion and recommendations.

### **Phase 1: Preliminary Study**

In the preliminary study, elements for IWRM enhancement were determined by collecting and reviewing related documentation. To evaluate the critical elements, content and matrix analysis were employed to describe each selected element's characteristics.

The use of the IWRM toolbox and adaptation of good governance elements from selected research articles was used in this study.

The elements of IWRM and good governance principles were taken from a review of the available literature on the subject and used as variables in this study. Table 3 and Table 4 show the list of important variables used in this study.

### **Phase 2: Data Collection**

Output in Step 1 (IWRM enhancement elements: IWRM-good governance elements) was used as an input in this step to prepare a questionnaire.

A 5-point Likert scale was applied to the responses for the questions. A pilot study was also carried out to ensure the reliability of the questionnaire. The reliability pilot test collected data from 30 subjects who were not included in the sample.

Thus, 30 respondents ranging from academicians, NGO workers, and water resource personnel, were selected. The data was then analysed using Cronbach's Alpha Reliability Test.

The results of the test showed that, all the data collected using the questionnaire was reliable, with an average score of 0.772 for IWRM elements and 0.915 for good governance elements.

The respondents to the survey consisted of those who were involved in the IWRM best management practices project. As shown in Table 4, eight projects in Peninsular Malaysia were the focus of this research paper.

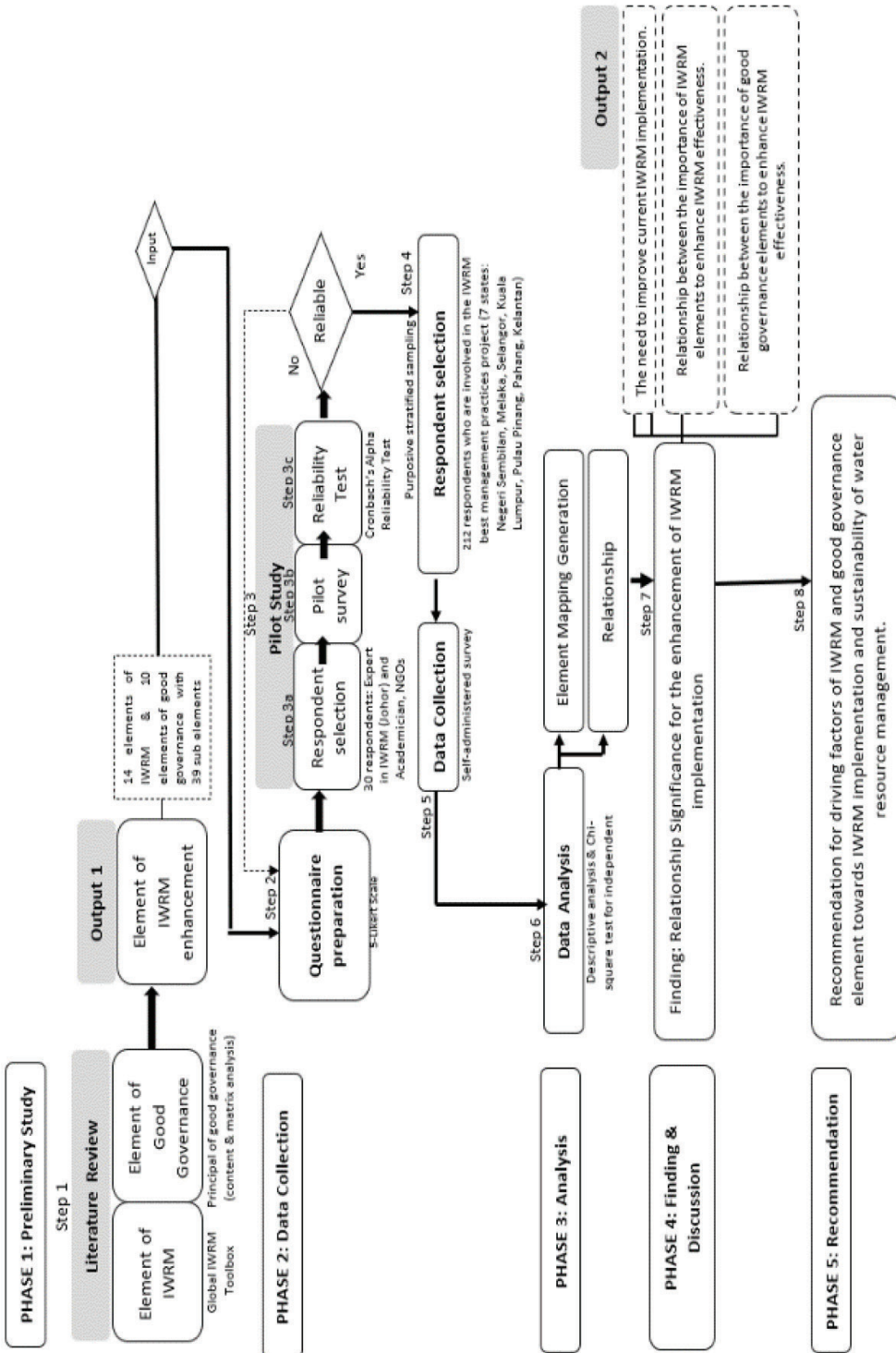


Figure 3: Research process phases

Table 3: Elements of IWRM (GWP, 2003; Gabrielli, 2008)

Cluster of IWRM	IWRM Elements
A-Enabling environments	A1- Policy A2- Legislative framework A3- Financial and incentive structure
B-Role of institutions	B1- Organisation framework B2- Institutional capacity development
C-Management instruments	C1- Water resources assessment C2- IWRM Plan C3- Efficiency in water consumption C4- Instruments of social change C5- Conflict resolution C6- Regulatory instruments C7- Economic instruments C8- Exchange of information C9- Instrument assessment

Table 4: Elements in good governance

Good Governance Principles	Elements in Good Governance	Reference
Legislation	L1- Legal reliability L2- Unbiased of law enforcement L3- Freedom of the judicial system L4- No intervention of any power	Adapted from Rogers and Hall (2003); Biermann (2007), de Loe <i>et al.</i> (2009); Hassing <i>et al.</i> (2009); Lockwood <i>et al.</i> (2010); OECD (2011); Lautze <i>et al.</i> (2011); UNEP (2012); Mccall and Dunn (2012); UNDP (2014)
Participation	P1- The right to freedom of expression P2- Access to information between parties P3- Mechanism of evaluation for participation P4- Validity in decision making (from planning to implementation) P5- Gender and equity ethics during the participation process	
Effectiveness	EF1- The knowledge on water issues EF2- The knowledge on factor of water issues EF3- The aim of policy in solving the root cause of water issues EF4- Integration between policies in various sectors EF5- Ability to influence some parties EF6- Ability to coordinate the action EF7- Ability to implement	
Efficiency	EN1- Minimise financial, political, social, and environmental costs EN2- Minimise transaction costs	
Equity	EQ1- Reduction of distribution power differences related to income, gender or ethnicity in obtaining resources or results EQ2- Formation and application of impartial laws	
Responsive	R1- Relationship with all stakeholders R2- Delivery of accurate results at the request of stakeholders R3- Give a response to things that are at the lowest level R4- Response from other relevant parties	

Transparency	T1- Access to procedural knowledge T2- Access to sufficient information T3- Information that can be understood
Cooperative	I1- Participation approach for an agreement I2- Collaborative approach I3- Mediation mechanism to enhance cooperation between regions, sectors, or regions
Accountability	A1- Duty to answer to things that affect others A2- Access to open forums in giving answers to a problem A3- Clarity of rules A4- Identify the direction of the mind A5- Monitoring policy A6- Exposure to achievement is either at a good level or less A7- Accountability between the government, the private sector and the public
Flexibility	F1- Provision of incentives and regulations to reduce conflicts between sectoral strategies to find solutions that are in line with local norms and governance F2- A decision taken must reach the community and they understand the decision

Hence, this study managed to obtain respondents who were experienced, have a high awareness and knowledge of IWRM procedures, and actively practiced the concepts related to IWRM in the administration and management of water resources in their respective departments.

Table 5 shows that the total population of the agencies involved in implementing the IWRM-BMP project was 425. Using purposive stratified sampling, the respondents were categorised into two types: key stakeholders and supportive stakeholders who were involved in the implementation of the IWRM-BMP project.

According to Collis and Hussey (2009), a total population of 400 requires a sample of 196, while a total population of 500 requires a sample of 217. In this study, researchers took a sample value of 212. A self-administered survey was carried out involving 212 respondents, of which 105 respondents returned the questionnaire. However, after the questionnaire's isolation process was done, out of the 105 questionnaires received, only 93 were completed and could be used for data analysis. Thus, the percentage of valid questionnaires used for this study was only 43%. The data was then analysed using descriptive analysis and the Chi-Square test.

### ***Phase 3: Data Analysis***

Descriptive analysis was conducted to determine the effectiveness of the existing IWRM implementation. Thus, two analyses were conducted, which were:

- (i) an analysis of stakeholder satisfaction and perceptions on the achievements with regards to existing IWRM implementation efforts and
- (ii) an analysis of the respondents' perceptions on the need to improve IWRM implementation through good governance.

Bycontrast, Chi-Square tests were conducted to determine the relationship between and the importance of IWRM and good governance elements to enhance the effectiveness of IWRM initiatives. In determining whether a variable has a relationship with each other or not, an evaluation needs to be done.

Therefore, to facilitate the evaluation, the relationship for each comparison made was evaluated using the interpretation of several Chi-Square test values. The  $\chi^2$  interpreted the degree of freedom (df) by referring to the table of critical values for the Chi-Square Test. If the calculated value for the degree of freedom was

Table 5: List of projects practicing IWRM best management practices and population sampling

Project	State	Region	Population
The use of water reservoir pond as a community park	Negeri Sembilan	South	25
Project of River Corridor Management and 'Sungai Angkat' in Sg Pengkalan, Alor Gajah, Melaka	Melaka		60
R&D Project: Identification and Management of Waterborne Diseases among River Communities in Sg Langat, Selangor	Selangor	Centre	55
R&D Project: Water Quality Rehabilitation through Environmental Flow Determination	Kuala Lumpur		80
Nega-liter Project Demonstration	Pulau Pinang	North	15
Groundwater Resource Management in Kota Bharu, Kelantan	Kelantan	East	60
River corridor management (urban area) along Sg Galing Besar, Kuantan, Pahang	Pahang		70
Poverty Eradication and Capacity Building among Local Communities in Swamp Area, Tasik Chini, Pahang			60
TOTAL			425

greater than the critical value in the table, then it shows a correlation between the two constructs studied, and the null hypothesis was rejected.

Next, the value of p was identified to determine the extent to which the relationship between the two variables studied was significant. If the p-value for this test was less than 0.05, this indicates that the correlation and relationship between the two variables studied were significant and vice-versa.

#### **Phase 4: Findings and Discussion**

The results are discussed in the following subsection.

#### ***The Effectiveness of Existing IWRM Implementation***

Based on Table 6, most of the respondents (63.4%) stated that the current IWRM implementation levels were ineffective as is and needed improvement. Meanwhile, 28.0% of respondents believed that the implementation of the existing IWRM initiatives were effective but still had room for improvement. The remaining respondents 8.6% said that the implementation of the existing IWRM was ineffective and needed to be amended.

Views from stakeholders on the need to improve the implementation of IWRM through

Table 6: Respondents' perception of satisfaction on the achievement of existing IWRM implementation

Achievements of the IWRM in Implementation	Frequency	Percentage (%)
Not effective and require amendment	8	8.6
Less effective and need improvement	59	63.4
Effective and need improvement	26	28.0
Total	93	100

IWRM and governance are also crucial in ensuring the effectiveness of this concept. The findings of the study in Table 6 show that most of the respondents, 47.3% agreed that good governance in the implementation of IWRM has the potential to be applied to ensure the effectiveness of IWRM implementation in the future. While 8.7% of the respondents also strongly believed that applying good governance to the implementation of IWRM was appropriate given the current water resources management situation.

However, 32.2% of the respondents were unsure whether it is necessary to improve the implementation of the existing IWRM through the elements of IWRM and good governance because it has never been implemented. Meanwhile, the remaining 11.8% of respondents disagreed because they felt it was unsuitable.

Most respondents felt that the concept of IWRM brought positive changes in the dimension of water resources management in Malaysia. However, on average, all of them were dissatisfied and felt that the implementation of this concept was less effective or ineffective because it was not conducted according to goals, methods, and practical actions, which were supposed to be continuous.

Therefore, improvements to the existing implementation of this concept need to be enhanced to achieve effectiveness.

### ***The Relationship between IWRM Elements and Good Governance Principles on Improving the Effectiveness of IWRM Implementation***

The Chi-square test for independence was used to obtain the relationship between IWRM elements and good governance principles. If the p-value for this test was more than 0.05, this indicates that there was no significant difference and relationship between the constructs studied.

Figure 4 shows a summary of the categories and variables involved in this analysis while Table 8 and Table 9 shows the result.

Table 8 reveals that there was a significant relationship ( $p < 0.05$ ) between the importance of IWRM elements as a component to improve the effectiveness of the existing IWRM implementation.

This analysis also shows that different elements of IWRM influenced the respondents' evaluation on the strength of the relationship between the effectiveness of IWRM implementation. In order to facilitate the data interpretation, the  $\chi^2$ , df, and p values for each IWRM element were collected, as shown in Table 8.

Out of 14 elements, seven were identified to have a value of  $\chi^2$  higher than the critical value (expected value) and have the most significant relationship. Many respondents agreed that elements A1 and C1 are essential and needed to be emphasised.

Table 7: Respondents' perceptions on the need to improve IWRM implementation through good governance

<b>The Need of Good Governance to Improve Existing IWRM Implementation</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Disagree because it does not fit due to it has never been implemented	11	11.8
Not sure	30	32.2
Agree because it has a potential	44	47.3
Strongly agree due to suitability in water resources management situation	8	8.7
<b>Total</b>	<b>93</b>	<b>100</b>

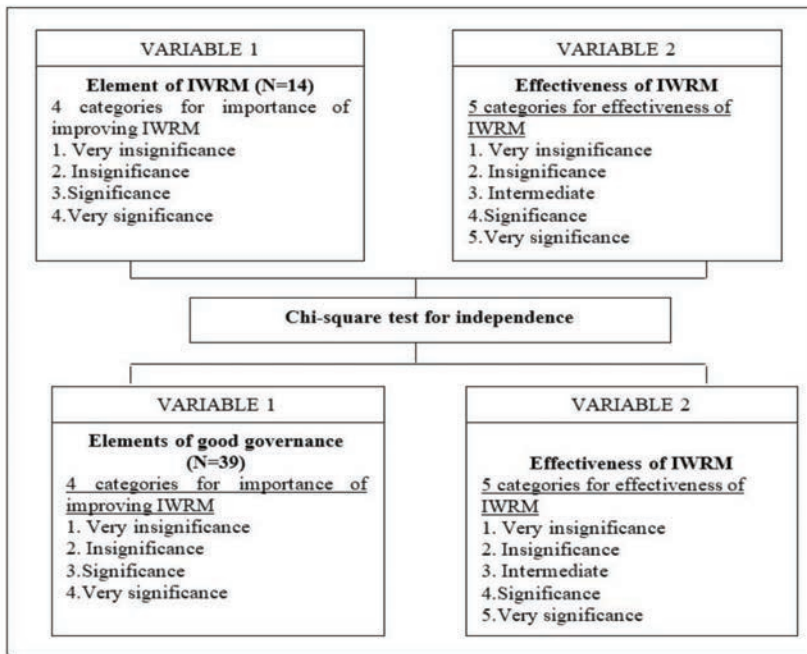


Figure 4: Variables and categories involved in Chi Square Test

Table 8: The relationship between improving the effectiveness of existing implementation based on the elements of IWRM

IWRM Elements	x <sup>2</sup>	df	Result of Chi Square Test		The Influence of Relationships
			Value of x <sup>2</sup> in Critical Schedule	Value of Significance (p)	
A1	22.511	21	21.03	0.048	/
A2	20.802	9	16.92	0.014	/
A3	21.110	12	21.03	0.050	/
B1	23.313	9	16.92	0.006	/
B2	21.884	9	16.92	0.009	/
C1	23.045	12	21.03	0.027	/
C2	16.523	9	16.92	0.057	X
C3	13.459	9	16.92	0.143	X
C4	19.315	12	21.03	0.081	X
C5	14.678	12	21.03	0.260	X
C6	11.799	12	21.03	0.462	X
C7	15.279	12	21.03	0.227	X
C8	14.905	12	21.03	0.247	X
C9	21.434	21	21.03	0.025	/



Policy (A1) is essential to a country's water resource management as water policy assists as a benchmark for the country to understand the existing situations or issues and propose a framework to create a system of laws and institutions, as well as a plan of actions with a unified national perspective.

For C1 (water resource assessment) and C9 (instrument assessment), they are important, especially in determining whether or not the goals of water resource planning have been met. In countries with good progress in IWRM implementation, the United Nations reported that vast IWRM elements have been fully implemented together with plans and programmes which need to be consistently assessed and revised periodically.

At the same time, elements A2, A3, B1, B2 and C9 are particularly essential elements to be considered in improving effective implementation of the existing IWRM. The legal framework (A2) provides the rules that need to be followed to achieve a policy and goal. These rules are important to preserve, protect, and manage conflicts.

For example, Mexico prepared a water law framework and proposed, as well as guided each state to develop their water laws that promote coordinated water resources management and development.

This approach is unlike that of Malaysia, where some complications were the result of state water resource-related enactments which differed in the jurisdiction, scope, and powers. This led to gaps, conflicts and duplication in enactments between federal and state laws.

Next, the financial, and incentive structure (A3) has a significant relationship which can enhance IWRM progress implementation. Access to adequate finance in IWRM implementation is a general constraint for progressive development. As was stated in the report, Malaysia has a shortage of funding due to national budget limitations, in which the funding was less than 50% of the agreed contributions in the water financing arrangement.

Meanwhile, for the elements of the organisation of the framework (B1) and institutional capacity development (B2), the role and structure of the institutions are different for each country.

However, dialogues and coordination mechanisms are important to ensure that some steps of integration can be undertaken. For example, there is a need to start investing in people by improving the recruitment procedures of state water management agencies to ensure qualified staff. Staff capacity is also encouraged to be fully equipped with the skills needed to improve IWRM implementation and provide education and training to raise public awareness on the importance of water and water conservation.

The remaining seven elements of IWRM, C2, C3, C4, C5, C6, C7 and C8 did not provide a significant relationship, especially with regard to improving the effectiveness of IWRM implementation.

As shown in Table 9, out of 39, 17 good governance elements were identified to have a value  $\chi^2$  higher than the critical value (expected value), i.e., fell within the critical area. As transparency is an important principle of good governance, most respondents stated that information which can be understood (T3) was significant enough to enhance the IWRM implementation. Access to information that can be understood, especially among the community, should be adequate and clearly stated to promote understanding. The procedure for decision-making must be open, especially to the public.

In terms of legislation, the unbiased law enforcement (L2) and the absence of an intervention by any power (L4) were the most significant elements to the respondents in the implementation of the IWRM.

With the existence of a sovereign law in the governance structure, the predictability of the law can be expected. There is no mixing of powers, impartial law enforcement, and independence of the judicial system. The parallel political and social structures allow for a

Table 9: The relationship between improving the effectiveness of existing implementation based on the elements of good governance

Good Governance Test	Result of Chi Square Test				The Influence of Relationships
	x <sup>2</sup>	df	Value of x <sup>2</sup> in Critical Schedule	Value of Significance (p)	
T1	14.047	12	21.03	0.298	X
T2	12.970	9	16.92	0.164	X
T3	21.687	12	21.03	0.012	/
I1	13.504	9	16.92	0.141	X
I2	11.117	9	16.92	0.268	X
I3	17.003	9	16.92	0.035	/
EQ1	11.282	12	21.03	0.505	X
EQ2	9.774	12	21.03	0.636	X
L1	12.299	9	16.92	0.197	X
L2	24.806	9	16.92	0.003	/
L3	8.472	9	16.92	0.487	X
L4	17.863	9	16.92	0.037	/
F1	18.890	9	16.92	0.026	/
F2	17.886	9	16.92	0.037	/
A1	21.137	12	21.03	0.006	/
A2	33.567	12	21.03	0.001	/
A3	16.927	9	16.92	0.006	/
A4	15.885	9	16.92	0.069	X
A5	0.625	9	16.92	0.302	X
A6	23.862	12	21.03	0.021	/
A7	20.996	9	16.92	0.013	/
EF1	11.767	9	16.92	0.227	X
EF2	17.438	9	16.92	0.008	/
EF3	13.812	9	16.92	0.129	X
EF4	14.308	9	16.92	0.112	X
EF5	10.216	12	21.03	0.597	X
EF6	20.330	12	21.03	0.864	X
EF7	25.036	9	16.92	0.003	/
EN1	14.159	12	21.03	0.291	X
EN2	12.982	12	21.03	0.370	X
R1	11.600	9	16.92	0.237	X
R2	17.112	12	21.03	0.145	X
R3	18.362	12	21.03	0.105	X
R4	14.113	9	16.92	0.118	X
P1	26.652	12	21.03	0.009	/
P2	21.459	12	21.03	0.007	/
P3	30.904	12	21.03	0.002	/
P4	17.203	9	16.92	0.046	/
P5	21.161	12	21.03	0.357	X

decision to be accurate and practicable. In terms of flexibility, the provision of incentives and regulations to reduce conflicts between sectoral strategies in finding solutions should be aligned with the local norms.

Governance (F1) and decisions taken must reach the community, as well as with the community's understanding of the decisions (F2) have been listed at the significance level. In other words, for the governance structure to be practical and flexible, there is a requirement that a decision taken must reach the community and be understood by them.

This will assist in overcoming instability or constant change, which can be achieved through the development of knowledge and peaceful conflict resolution appropriate to the locality where the situation or incident occurs.

Moving to the principles of accountability, most of its good governance elements were chosen by the respondents. The elements comprise of a duty to answer to things that affect others (A1), access to open forums in giving answers to a problem (A2), clarity of rules (A3), exposure to achievement is either at a good level or less (A6), and accountability between the government, the private sector, and the public (A7).

The government, the private sector, and the public must be held accountable for the actions and responsibilities they take, identify the direction of goals and thoughts, and be clear with the rules, so that the elements can demonstrate how those actions and responsibilities will best be implemented.

The respondents chose four good governance elements for the participation principles, namely the right to freedom of expression (P1), access to information between parties (P2), mechanism of evaluation for participation (P3), and the validity in decision-making (from planning to implementation) (P4). In the context of participation in IWRM activities, several aspects are emphasised: have access to information between parties, have an evaluation mechanism, legitimacy in decision-

making from the planning to implementation to the gender, and equity ethics during the participatory process is implemented. The last principle that had a significant relationship is effectiveness, which comprises two elements of good governance: the knowledge on factors that affect water issues (EF2) and the ability to implement effective solutions (EF7).

Governance is expected to be more effective if effective strategies and control structures for the IWRM implementation can be achieved. This can best be described as the integration between the policies in various sectors that can either influence the parties implementing an action or that even have the ability to coordinate actions.

Meanwhile, the remaining eight governance elements, such as T1, T2, I1, I2, L1, L3, EQ1, EQ2, EF3, EF4, EF5, EF6, P5, R1, R2, R3, R4 EN1 and EN2 did not provide for significant relationship differences in improving the effectiveness of the IWRM implementation.

### ***Phase 5: Recommendations***

The suggestions to emphasise the critical elements of IWRM and the good governance significance relationship developed through this study were used to enhance the IWRM work plan developed by the Global Water Partnership.

Thus, findings from this study not only revealed the driving elements of IWRM implementation, but also helped to create a guideline for overcoming water resource management issues. Therefore, this study recommends developing more variables that can be used as indicators for the success and effectiveness of the IWRM implementation at each state. Further emphasis should be placed on:

- i) Evaluating the performance of the current IWRM implementation progress by using the IWRM improved element framework.
- ii) Enhancing the strategic framework to evaluate the governance performance of IWRM implementation at the state, federal, and local levels.

- iii) Studying variables that can be used as indicators to enable the implementation of this framework of improved elements, which can help evaluate the current IWRM implementation rates of each state in Malaysia.
- iv) Forming a governance evaluation index to measure the IWRM implementation by making the framework of IWRM improved elements a conceptual framework.

## Conclusion

The study's objective was to prescribe a significant relationship between two categorised elements: IWRM and good governance, in determining the critical variables needed to develop a framework for the enhancement of the IWRM implementation.

The study also contributes to the current literature regarding IWRM implementation adoption rates by providing a further understanding of the current implementation progress and the challenges faced in IWRM implementation.

The results of the study identified seven out of 14 IWRM elements and 17 out of 39 good governance elements as significant factors and revealed a strong relationship between them that could improve IWRM implementation levels.

Thus, the study emphasises that effective governance in IWRM is significant to ensure the sustainability of water resources. These findings are in line with the global agenda, that is the SDG and studies from several IWRM researchers like Savenije and Van der Zaag (2000), Roger and Hall (2003), Keen (2003) and Wallace *et al.* (2003) which concluded that good governance was crucial to achieving success in the implementation of IWRM initiatives. Interestingly, this finding was also supported by the National Water Resources Policy (2012), which stated that, "good governance is essential towards ensuring the security and sustainability of water resources as well as the achievement of common goals towards addressing multiple

water resources governance concerns and priorities."

In conclusion, the effectiveness of IWRM implementation procedures can be enhanced and supported using the significant elements highlighted in this study as variables. This paper concludes that there is a need to develop a good governance strategic framework of assessment as a work performance guideline for various stakeholders in the future.

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