

Hong Kong's Water Quality Governance: A Historical Perspective Policy Instruments and Priorities

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ABSTRACT

Based on 112 water quality-related proceedings of the Hong Kong Legislative Council from 2014 to 2025, this study employed an analytical framework of policy tools, policy issues, and time evolution to investigate Hong Kong's water-quality governance agenda. The findings indicate that command and control were mentioned most frequently, followed by public information, participation and collaboration, public investment, and economic incentives. Overall, the policy-tool discussion evolved from a regulation-dominated configuration toward a more diverse combination. In terms of policy issues, water pollution, water infrastructure, and sewage treatment received the most attention. The coded instrument-issue links suggest an association between problem characteristics and instrument configurations: topics with clear responsibility boundaries and compliance requirements were more often associated with command and control; topics involving engineering construction and technological improvement were more related to public investment and economic incentives; while topics involving behavioral change or multi-actor cooperation were more often associated with public information and participation and collaboration. The research shows that Hong Kong's water quality governance agenda included administrative regulation, economic tools, and discussion of stakeholder participation, with attention gradually expanding from pollution control to infrastructure improvement, ecological protection, and governance resilience.

Introduction

Hong Kong (HK) faces congenital water scarcity due to the lack of major natural rivers, lakes, and usable groundwater (Zhang et al. 2021). To cope with the water demand brought about by population growth and urban development, HK began to build reservoirs earlier and set up a non-traditional water supply system represented by seawater flushing. However, local water harvesting has always been difficult to meet the overall demand. At present, Dongjiang water accounts for a large proportion of HK's total water consumption, and the proportion of locally collected rainwater is relatively limited (WSD, 2022). The Dongjiang River Basin supports the population and economic activities of many cities in the Pearl River Delta, and the per capita water resources are relatively limited. Industrialization, land use change, ecological degradation, and climate change affect the runoff and water environment of the basin (Yang et al., 2018), and the water demand among different cities also increases the difficulty of regional coordination (Huang et al., 2022). Meanwhile, sea-level rise and extreme weather have put new pressure on coastal drainage and water supply facilities. Therefore, HK's water problem is not only about the adequacy of water, but

also about the safety of water sources, pollution control, and infrastructure resilience. Recent research has further characterized HK's water system as technocratic and supply-oriented, highlighting continuing challenges associated with external dependence, institutional coordination, and resilience (Wang and Dai, 2021).

Water quality issues reflect the complexity of urban water management. They are affected by multiple factors, such as pollution discharge, seasonal changes, and human activities. Different stakeholders may also have different understandings of the source of the problem and the focus of governance (Houser et al., 2022). The decline of drinking water or environmental water quality directly affects public health and daily life (Olusegun et al., 2022) and may aggravate the contradiction of water resources among regions, industries, and users (Choi et al., 2017). Even in areas with relatively perfect supervision and treatment facilities, drinking water quality violations may still exist (Allaire et al., 2018). This means that water quality control cannot rely only on technical monitoring or a single administrative measure but also needs to make arrangements among law enforcement, public investment, departmental coordination, and social participation.

The existing literature on water quality policy has studied comparative analyses of water quality policies (Kim et al., 2021), key influencers (Isaac and de Loë, 2022), how policies address water quality violations (Allaire et al., 2018), and the benefit-cost analysis of policies (Keiser et al., 2019). Moreover, the use of policy tools (Drevno, 2016) and the process of policy adaptation (Kim et al., 2021) in water governance are also research focuses. This study employs a three-dimensional framework of policy tools, policy topics, and temporal evolution to analyze HK's Legislative Council (LegCo) meeting records on water quality from 2014 to 2025. As a densely populated coastal city, HK faces problems such as external water supply dependence, aging infrastructure, urban water pollution, drinking water safety, and marine ecological protection. Relevant issues often enter the LegCo's policy discussions. Although the records of the LegCo proceedings cannot present the whole process of policy formation and implementation, nor the importance and degree of policy implementation, the visibility of issues and instruments in LegCo proceedings can reflect the issues that received formal attention and measures that the government has publicly proposed. A systematic analysis of water-quality policy discussions in HK is not only necessary for local water issues but also provides experience and reference for global sustainable water governance. The research question in this study is how the policy instruments and water-quality issues discussed in HK LegCo proceedings changed between 2014 and 2025 and how they were linked.

The remainder of the article is as follows. Section 2 presents the literature review and analytical framework. Then, the next section is the methodology. Section 4 presents the analysis of policy tools, topics, and temporal evolution in water-quality policy discussions in HK. The last section is the discussion and conclusions.

Literature review and analytical framework

Policy tools are the means by which the government transforms policy objectives into concrete actions. Hood (1983) summarized policy tools as information, authority, finance, and organization according to the resources that the government can mobilize. Salamon (1989) pointed out that governance does not only rely on the direct provision of services by the government but also includes subsidies, loans, contracts, regulations, and information dissemination. The use of policy tools is influenced by the existing system, governance methods, and policy objectives, and is embedded in the policy system (Capano and Howlett, 2020). The combination of different tools reflects the current policy. Rogge and Reichardt (2016)

proposed that a policy combination includes not only several independent tools but also policy objectives, the implementation process, and the relationship between tools.

Existing studies have also investigated how different policy tools coexist, supplement each other, and work together (Rogge and Reichardt, 2016; Domorenok and Zito, 2021). This perspective is especially relevant to water quality governance because pollution control, infrastructure, and ecosystem protection are concerned with different responsibilities. In water governance, policy objectives and characteristics of policy issues influence the combination of policy tools (Kirsop-Taylor et al., 2022; Bréthaut et al., 2024). However, the literature has limited research on how policy instruments and water quality issues are connected in water quality policy agendas over time, particularly in densely populated Asian cities. This study addresses this gap by examining the changing visibility and linkages between policy instrument categories and issues in the HK LegCo proceedings.

In water quality governance, traditional pollution control is usually based on discharge standards, permits, and administrative penalties; however, the sources of water pollution are increasingly complex, and some problems are difficult to solve by a single regulatory measure (Bolognesi and Fischer, 2025; Eberhard et al., 2021). Drevno (2016) pointed out that agricultural non-point source pollution involves a large number of scattered land users, whose pollution sources are not easy to identify and monitor, and there are limitations in relying only on technical standards and law enforcement. Therefore, regulatory, financial incentives, technical assistance, and basin coordination measures are often adopted. The development of European water policy also reflects the gradual expansion of policy tools. It has gradually shifted from dealing with specific pollutants and water use sectors to integrated water management (Giakoumis and Voulvoulis, 2018). South Korea's water policy reform also uses infrastructure investment, pollution charges, water price adjustment, and demand management (Choi et al., 2017). These studies show that regulatory tools are still an important basis for water quality governance, but with the expansion of governance issues, financial and information tools are also important.

Based on the above research, this paper took policy tools as the first analytical dimension and divided the policy tools in water quality management into five categories: command and control, economic incentives, public investment, public information, and participation and collaboration. Command-and-control tools rely mainly on legal provisions, mandatory standards, and administrative law enforcement to restrict the behavior of relevant subjects. Economic incentive tools affect behavior choices through charges, subsidies, and taxes. Public investment refers to the direct provision of resources by the government. Public information includes publicity, education, and other one-way information measures intended to affect behavior. Participation and collaboration concern relationships between the government and stakeholders. Information dissemination is not an auxiliary link of policy.

Existing studies have analyzed water quality policy issues from different perspectives. Allaire et al. (2018) examined the long-term trend and regional differences of water quality violations using U.S. drinking water data. Keiser et al. (2019) evaluated U.S. water quality policy from the perspective of cost-benefit. Such studies focus on the results of policy implementation and its evaluation. Other studies focus on how water quality issues are defined and how different actors affect policy discussions. Houser et al. (2022) took the Brantas River Basin in Indonesia as an example and found that different stakeholders have different understandings of the source, responsibility, and treatment scheme of water quality problems. Isaac and de Loë (2022) pointed out that agricultural subjects can influence water quality policies through discourse and problem framing. The content and expression of public propaganda will affect how policy target groups understand environmental issues and may also affect their willingness to participate and behavior choices

(Park et al., 2020). These studies show that what enters the policy agenda is not unexplained objective issues, but policy issues that have been selected, classified, and expressed. This paper took policy issues as the second analytical dimension to identify the main concerns reflected in water quality policy discussions.

Policy evolution is temporal. Existing regulations, departmental responsibilities, and infrastructure have a continuous impact on subsequent policy choices, and new pollution problems, public events, social pressure, and scientific knowledge may also change policy priorities (Choi et al., 2017). Historical research on water quality policy shows that policy change is often not one tool that is quickly replaced by another tool, but that the original measures are modified, expanded, or recombined. Kim et al. (2021) compared the evolution of water quality policies in Oregon and South Korea and found that serious pollution incidents, public pressure, government supervision, and financial support promoted the strengthening of point-source pollution regulation. With the gradual control of point-source pollution and the entry of non-point-source pollution into the policy agenda, the original regulatory system also needs to increase monitoring, technical support, capital planning, and local cooperation. Giakoumis and Voulvoulis (2018) showed that the transition from sectoral management to comprehensive governance is a process of continuous adjustment, and the new policy objectives usually need to be gradually implemented in the original legal and administrative system. Therefore, this study takes time evolution as the third analysis dimension to examine changes in policy tools and policy issues over time.

Moreover, different characteristics of governance problems may create different requirements for policy instruments. Issues with clear responsibility boundaries and compliance requirements may be more compatible with command and control instruments because responsible actors and prohibited behaviors can be identified. Issues involving infrastructure construction or technological upgrading require substantial resources and therefore tend to involve financial instruments. In contrast, issues involving behavior change or coordination among dispersed actors may rely more on participation and collaboration. From this perspective, diversification is not simply an increase in the number of instruments but may also reflect the adaptation and recombination of instruments in response to different governance problems.

HK is an appropriate case for observing such changes. Water quality issues in HK are diverse and involve water supply, pollution control, sewage treatment, drainage, and the marine environment. The LegCo of HK has recorded regional complaints, environmental incidents, and government measures through budget deliberations and policy discussions (Legislative Council, 2024). This study establishes a three-dimensional analysis framework for policy tools, policy issues, and time evolution. It analyzes and compares the changes in policy tools and policy topics reflected in the records of the LegCo proceedings of HK from 2014 to 2025. Policy tools describe how the government responds to problems, and policy issues describe the problems the government is responding to. The temporal dimension examines how these two aspects change over the study period.

Methodology

This study conducted a content analysis of the records of the HK LegCo proceedings. The database search covered proceedings published between 1 January 2014 and 31 December 2025. The council meetings allow councilors to ask the government to respond to councilors' reported questions, discuss critical issues, and supervise the government's work. Therefore, the official records of the LegCo proceedings in HK present a record of issues receiving formal attention in the legislature. The definition of policy is "the content or substance of policy making, including objectives, programs, regulations, laws, and funding priorities" (Markard et al., 2016, p. 217). LegCo meetings record formal legislative attention,

councilors' questions, and government responses concerning water-quality issues. Therefore, although they do not constitute the complete population of water-quality policies or implementation activities in HK, these proceedings serve as an important reference for understanding and analyzing the policy agenda attention and the policy instruments discussed.

The bilingual LegCo database was searched using English and Chinese water quality-related terms. The English terms included “water,” “waters,” “waterfront,” “waterworks,” “sewage,” “sewers,” “drainage,” “river,” “rivers,” “water-friendly,” “leachate,” “sea,” “marine,” “coastal,” “tides,” “seawater,” and “flooding.” The corresponding Chinese terms were used to determine if any proceedings were omitted. All search results were manually screened. Only when the record contained a substantive discussion of at least one water quality-related issue would it be included, even if water quality was not its principal topic. Records with only incidental keywords were excluded (such as discussions on maritime insurance). Moreover, proceedings concerning water supply, conservation, recycling, marine ecosystems, or infrastructure were included only when they were related to water quality, source protection, drinking water safety, pollution prevention, or wastewater treatment. The final sample contained 112 records.

This study develops a three-dimensional analytical framework encompassing policy tools, policy topics, and temporal evolution to analyze the text. In terms of policy tools, command-and-control tools include laws, mandatory standards, permits, inspections, law enforcement, penalties, and mandatory rectification. Economic incentives include charges, subsidies, tax incentives, and other financial mechanisms intended to influence the choices of policy target groups. Public investment includes direct government expenditure on infrastructure, public works, project funding, research, and technical support. Public information includes publicity, education, and other one-way information measures. Participation and collaboration include consultation, public participation, and industry cooperation. In addition, the study identified 9 main topics within the texts. They are water conservation, drinking water quality, marine ecosystem, water pollution, foul water seepage in buildings, sewage treatment, water infrastructure, water recycling, and water supply. For example, “water pollution” mainly involves pollution sources, discharge, and deterioration of water quality, while “sewage treatment” refers to the collection, treatment, and disposal of wastewater. A meeting record can contain multiple tools and topics.

The study also identified the links between instruments and issues. A link was coded only when the text explicitly connected a policy instrument to a particular issue. A proceeding could contain multiple links. Before full-sample coding, the two coders independently coded approximately 20% of the sample (22 proceedings) stratified by year. They then compared the coding results and discussed disagreements to harmonize the coding unit, category definitions, inclusion and exclusion rules, and the treatment of ambiguous cases. In this pilot reliability assessment, before reconciliation, the average raw agreement across the policy-issue and policy-instrument indicators was 86.0%, and the mean category-specific Cohen's κ was 0.62. After the coding criteria were agreed, the primary coder coded the full sample using the finalized protocol. For frequency analysis, the unit of analysis was the proceeding. A category was coded as present if at least one substantive statement met its definition, and repeated mentions within a proceeding were not counted more than once.

Results

Overall distribution of policy instruments and issues

This study analyzed 112 LegCo proceedings related to water quality governance in HK. The same record can involve multiple policy instruments or discuss multiple issues. The results show that command

and control were mentioned most frequently, accounting for 48.2% of the total. Public information was mentioned in 35.7% of the proceedings, followed by participation and collaboration (29.5%), public investment (27.7%), and economic incentives (25.9%). Fifty records mentioned two or more tool categories, accounting for 44.6% of all samples. The most common two-tool combination was command and control with public information, which appeared in seven cases.

For command and control, the proceedings mentioned the legal basis, such as the Water Pollution Control Ordinance, Water Utilities Ordinance, and Waste Disposal Ordinance, multiple times. The proceedings describe different departments carrying out law enforcement according to their duties. For example, the Environmental Protection Department (EPD) is responsible for the discharge permit and illegal discharge, the Drainage Services Department (DSD) is responsible for sewage collection and drainage facilities, the Food and Environmental Hygiene Department (FEHD) is responsible for dealing with the garbage and health problems of some waterways, and the Marine Department (MD) is involved in the response to oil pollution accidents at sea. Discussions on pollution along the coast of Victoria Harbour, sewage discharge from the catering industry, illegal dumping at sea, and building seepage usually require the responsible parties to respond regarding law enforcement progress and rectification arrangements.

Economic incentives include charging systems, tax incentives, and subsidies for residents and institutions. For example, sewage charges reflect the “polluter-pays” principle; environmental protection facilities and green technologies can obtain tax support; and the proceedings described the “Water Safety Plan Subsidy Scheme” as assisting buildings to improve the internal water supply system through subsidies. These instruments use financial incentives or disincentives to affect the choices of policy target groups.

Public investment includes direct government expenditure on infrastructure, public works, projects, research, and technical support. Water supply network improvement, sewage treatment facilities, seawater desalination projects, and public funding for water and marine technology research are included in this category.

Public information includes publicity and education-related activities. The proceedings on water conservation mentioned leaflets, warning signs, and public activities such as “Save Water Today for a Sustainable Future”. Marine ecological governance also included public education and fishermen’s training. Compared with administrative punishment, these measures rely more on information dissemination and behavioral guidance.

Unlike one-way information provision, participation and collaboration require interaction, coordination, and joint participation among actors. Some measures were described in the proceedings as being jointly implemented by government departments, social organizations, schools, enterprises, communities, or other stakeholders.

In terms of policy issues, water pollution appears most frequently, mentioned in 42.9% of proceedings, followed by water infrastructure and sewage treatment, mentioned in 38.4% and 26.8% of proceedings, respectively. Water pollution is a long-term issue. The problems of water quality and odor in Victoria Harbour and Tsuen Wan waterfront have occurred repeatedly over many years. The proceedings reported government measures such as dredging of canal pipes, diversion of rain and sewage, closure of facilities in the dry season, and deodorization materials, as well as requirements for relevant buildings to correct incorrect pipeline connections. However, due to the lack of owner organization in some buildings, investigation, negotiation, and engineering rectification often take a long time. Relevant records indicate that implementation difficulties were discussed in relation to factors such as the decentralization of property rights, project cycle, and departmental coordination.

Discussions on water infrastructure include water supply networks, rainwater and sewage systems, water treatment facilities, flood control works, seawater desalination, and intelligent monitoring. The proceedings mentioned that the Water Supplies Department (WSD) had established a district metering and monitoring system in the water supply network to detect leakage and regulate water pressure, and continued to replace aging water pipes. After the typhoon damaged the sewage treatment facilities in 2018, more attention was paid to disaster resilience, emergency preparedness, and service continuity under extreme weather conditions. The frequent occurrence of water infrastructure issues in the proceedings reflects that engineering construction and technical maintenance remained a recurrent focus of the formal policy agenda.

The discussion of sewage treatment has gradually expanded from traditional sewage collection and facility maintenance to microplastics, antibiotics, and new pollutants. The LegCo discussed not only the maintenance of sewage treatment plants and public sewers, but also the impact of inadequate drainage systems in rural areas, drainage pipe inspections of private buildings, and scientific research findings on treatment standards.

Marine ecological issues include red tide, fish death, marine garbage, abandoned fishing nets, illegal dumping, and the impact of coastal development projects on the ecological environment. In view of the red tide and large-scale fish deaths, the proceedings reported government measures, such as water quality monitoring, disaster assistance, and fishermen's training.

Compared with the above issues, water conservation, water supply, and water recycling occur less frequently. Relevant records mention the uncertainty of Dongjiang water supply, desalination of seawater, reclaimed water, rainwater collection, utilization of grey water, pipe leakage, and water fee adjustment. Moreover, although there are only seven records of foul water seepage in buildings, the problem has a strong impact on residents' lives. The relevant discussions mainly involve the investigation efficiency, departmental responsibilities, coordination among building owners, and inspection and maintenance of drainage facilities in old housing estates.

The study also analyzed the associations between policy issues and tools. Table 1 shows the associations. Cells report the number (percentage of proceedings containing the issue) in which the instrument was explicitly linked to that issue. Multiple instrument-issue links could be coded within one proceeding; therefore, row percentages do not necessarily sum to 100%. Of the 112 proceedings, 84 contained at least one explicit instrument-issue link, yielding 164 coded links.

Table 1. The linkage between policy issues and tools

Policy issues	Counts	Command and control	Economic incentives	Public investment	Public information	Participation
water pollution	48	28 (58.3%)	2 (4.2%)	6 (12.5%)	8 (16.7%)	3 (6.2%)
water infrastructure	43	4 (9.3%)	5 (11.6%)	11 (25.6%)	3 (7.0%)	3 (7.0%)
sewage treatment	30	6 (20.0%)	7 (23.3%)	6 (20.0%)	4 (13.3%)	4 (13.3%)
marine ecosystem	15	7 (46.7%)	0	2 (13.3%)	8 (53.3%)	3 (20.0%)
drinking water quality	13	4 (30.8%)	2 (15.4%)	3 (23.1%)	5 (38.5%)	3 (23.1%)
water supply	10	0	3 (30.0%)	1 (10.0%)	2 (20.0%)	0
water conservation	9	0	2 (22.2%)	1 (11.1%)	3 (33.3%)	1 (11.1%)
water recycling	8	1 (12.5%)	0	0	1 (12.5%)	1 (12.5%)
Foul water seepage	7	7 (100.0%)	1 (14.3%)	1 (14.3%)	1 (14.3%)	1 (14.3%)

Source: Compiled by the authors

Water pollution was most often directly linked to command and control (28 of 48 proceedings, 58.3%), and foul water seepage was linked to command and control in all seven relevant proceedings. Discussions on coastal pollution, illegal discharge, landfill leachate, and dumping at sea usually require the government to identify the source of pollution, implement discharge permits, or investigate illegal responsibility. The cases of Victoria Harbour and Tsuen Wan waterfront reflect this feature. The wrong connection of sewage pipes requires investigation and administrative orders. However, law enforcement alone cannot solve the problem.

The relevant discussions also linked water pollution to investment in the reconstruction of canal pipes, dry-season closure facilities, information provision, and negotiations with private buildings to correct the pipeline. Some water pollution proceedings also contained direct links to public investment (6), public information (8), or participation and collaboration (3).

Water infrastructure was most often linked to public investment, while sewage treatment showed links to several instrument types. For example, water supply network monitoring, aging water pipe replacement, sewage treatment plant facility maintenance, and seawater desalination projects were coded as public investment when they involved direct government provision. By contrast, tax incentives, charges, and subsidies were coded as economic incentives. Separating these categories distinguishes direct public expenditure from financial mechanisms intended to influence behavior.

For water conservation, public information was the most frequent direct link, followed by economic incentives. For water supply, economic incentives were most frequent, followed by public information. Water fees, subsidies, and water-saving equipment are related to economic means, while water resources protection publicity, water-friendly culture, and water-saving initiatives rely on information provision.

Discussions of marine ecosystems often include public information and command and control. Illegal dumping and marine pollution require law enforcement, while public education and information are used to raise awareness of marine protection.

In general, the distribution of policy instruments varied across topics. For issues with clear responsibility divisions, involving illegal or compliance requirements, command and control was more commonly linked. Engineering and technical issues were more often linked to public investment, and in some cases, economic incentives. Public information was more often linked to behavior guidance, while participation and collaboration were more visible in issues requiring coordination among residents, industries, organizations, or regions. Moreover, the same water quality issue often includes regulatory, funding, information, and participation needs at the same time, and the policy measures still depend on the policy content discussed.

Temporal evolution analysis

The trends and issues of the relevant proceedings reflect formal agenda attention and official responses over the years. Figures 1-3 show the changes in policy tools and issues reflected in the relevant proceedings from 2014 to 2025. Figure 1 shows the annual proportion of policy tools mentioned in proceedings.

Overall, the proceedings show a shift from discussions dominated by command and control toward a more diverse mix of policy instruments. Because the number of relevant proceedings varied across years, the annual proportions should be interpreted together with the issues discussed in the proceedings. In years with few proceedings, one or two records can substantially affect the percentages of proceedings. In the early days, command and control were mainly discussed in relation to pollution discharge, drinking

water safety and drainage facilities. In the later stage, regulatory tools remained recurrent, while public investment, economic incentives, public information, and participation and collaboration appeared in different combinations. Therefore, the recurring discussion of regulatory tools reflects the importance of pollution control and facility management in HK's formal policy agendas.

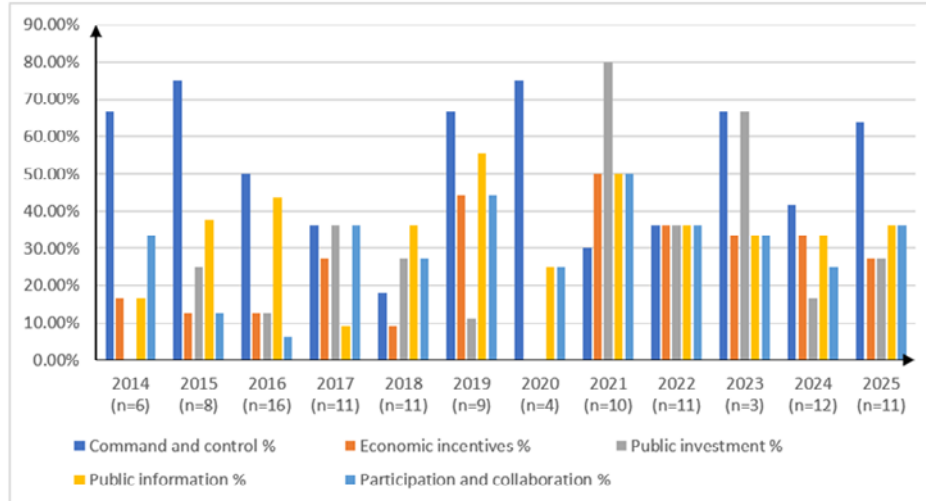


Figure 1. Annual proportion of policy tools mentioned in proceedings

Source: Compiled by the authors

As Figure 2 shows, economic incentives and public investment followed different annual patterns. Economic incentives mainly included pollution charges, fees, tax incentives, and subsidies, whereas public investment included infrastructure construction, project funding, research funding, and technical support. Public investment was particularly visible in later-year discussions involving infrastructure, technology development, climate policy, and green projects. The increased discussion of economic tools also reflects the expansion of policy areas represented in the LegCo water-quality agenda.

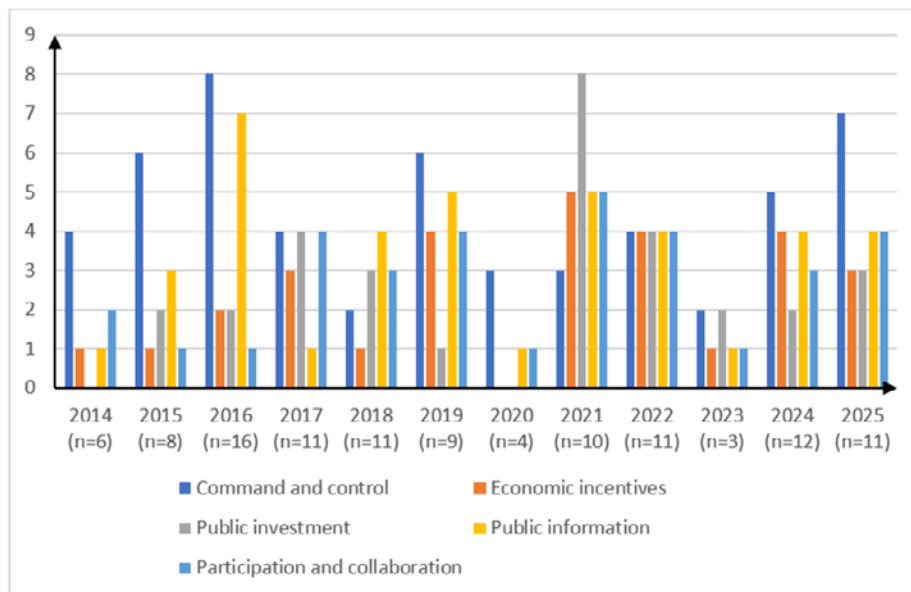


Figure 2. Policy tools mentioned in proceedings

Source: Compiled by the authors

Public information and participation also showed different patterns. Public information appeared in discussions of water-saving publicity, public education, training, and awareness campaigns, while participation and collaboration covered community projects, industry involvement, consultation, and cross-sectoral or cross-border cooperation. These separate trends indicate that greater visibility of information measures does not necessarily imply a corresponding increase in stakeholder participation.

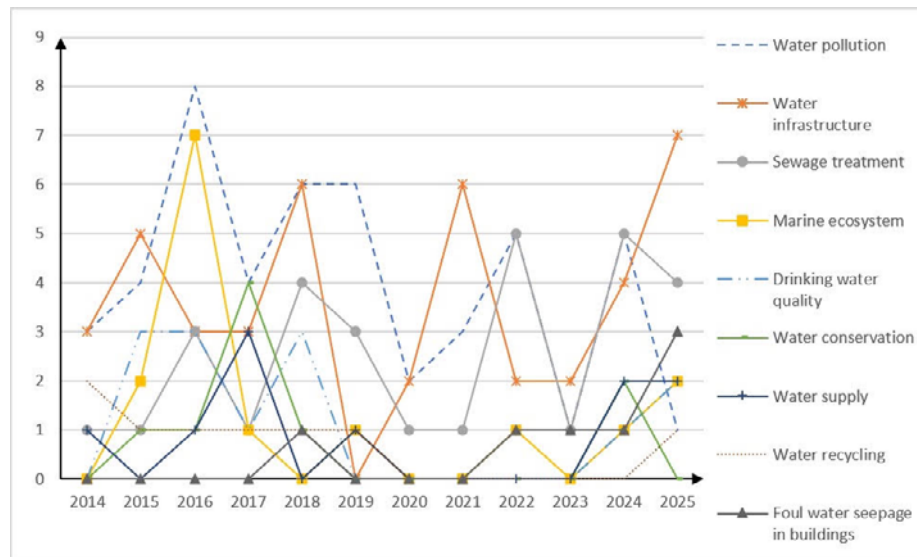


Figure 3. Policy topics mentioned in proceedings
Source: Compiled by the authors

From the perspective of policy issues, water pollution has always been an important part of the discussion on water quality in LegCo proceedings. Its variation was associated with public complaints and government follow-up. Many pollution problems were repeatedly placed on the agenda during investigations, project implementation, and responsibility coordination.

Water infrastructure has maintained relatively stable policy concerns. Its content has gradually expanded from the maintenance of general water pipes, drainage, and sewage facilities to intelligent monitoring, desalination of seawater, extreme weather response, and infrastructure resilience. The persistence of infrastructure issues shows that engineering and technical measures remain a recurrent focus in LegCo discussions of water quality and safety.

Sewage treatment has received more attention in later stages. In addition to traditional sewage collection, sewer maintenance, and treatment plant operation, the discussion began to involve microplastics, antibiotics, and the drainage of rural and private buildings. The expansion of sewage treatment issues is related to the gradual transformation of long-term pollution problems into pipe network and treatment capacity issues and is also affected by scientific research and discussion of new pollutants.

Discussions of marine ecosystems were more event-driven. Red tide, fish death, marine garbage, and pollution accidents have raised attention to relevant issues. Meanwhile, later discussions on marine ecology were no longer limited to accident handling but also linked to island development, ecotourism, public education, and Shenzhen-HK cooperation.

The discussion on drinking water quality mainly started from the lead contamination incident in HK in 2015. In the early stage, the focus was on water quality standards, engineering supervision, and legal responsibility. It gradually turned to system implementation and building internal water supply management.

The discussion of the Water Safety Plan Subsidy Scheme indicates attention to implementation at the building level, extending the earlier focus on drinking water safety.

Changes in water conservation, supply, and recycling were relatively scattered across the country. The Dongjiang water supply risk, climate change, and water source diversification were discussed in connection with these issues in LegCo. However, compared with pollution control, facility construction, and sewage treatment, policy concerns lack continuity.

The policy agenda reflected in the proceedings was associated with different factors. Residents' complaints and councilors' supervision were often accompanied by government responses to specific pollution, drainage, and facility problems. External events, such as drinking water safety incidents, red tides, and extreme weather, were associated with short-term shifts in policy attention. Scientific research, international experience, and the sustainable development agenda were associated with the discussion of new topics such as climate adaptation in the water-quality policy agenda.

Discussion

There are several key findings of the study. First, the water quality-related policy discussions in HK shifted from a dominant focus on command and control toward a mixed pattern that also included economic incentives, public investment, public information, and participation and collaboration. The observed diversification of policy tools suggests that the formal policy agenda is not limited to government regulation and public works, but also includes financial incentives, information provision, and discussion of roles for other actors, such as residents, enterprises, and social organizations. References to participation and collaboration indicate that these approaches are visible in policy discussions, but they do not demonstrate that meaningful participation or co-production occurred in practice. Such agenda-level attention is consistent with the literature discussing the value of co-production (Kedzior, 2017; Giakoumis and Voulvoulis, 2018; Gautam and Lamichhane, 2026).

Second, the explicitly coded links suggest that policy instrument configurations vary with the characteristics of water quality issues. For example, when the polluters are scattered and it is difficult to directly monitor their behaviors, relying only on compulsory regulation is often insufficient. The solution also requires financial support, technical assistance, and inter-subject coordination (Drevno, 2016; Giakoumis and Voulvoulis, 2018). In this study, issues such as water pollution, illegal discharge, and building seepage usually have clear compliance requirements. Thus, they were often directly linked to supervision, inspection, and compulsory rectification. Water infrastructure and sewage treatment involve long-term construction, facility maintenance, and technology upgrading. They were directly linked to public investment as well as economic incentives such as charges or subsidies. Topics such as marine ecology, water resources protection, and water conservation also distinguish between public information used for awareness or behavior guidance and participation and collaboration used for interaction among dispersed actors. Although the present design does not establish a causal process of instrument selection, these patterns are consistent with a problem-instrument matching mechanism in the formal policy agenda. Where responsibility and compliance requirements are identifiable, regulatory instruments are more visible; where resource requirements are substantial, public investment becomes more relevant; and where governance depends on behavior guidance or coordination among multiple actors, information and participatory instruments become more visible. The HK case therefore suggests that diversification in the formal policy agenda may take the form of problem-related recombination of instruments around different problem characteristics, rather than the replacement of one dominant instrument by another.

Finally, in terms of research topics, water pollution, water infrastructure, and sewage treatment appeared more frequently. This suggests that water quality-related discussions in the HK LegCo focused on specific, identifiable issues that could be addressed through administrative or engineering measures. Pipe network monitoring, sewage facilities, desalination of seawater, replacement of aging water pipes, and investigation of pollution sources all have clear departmental responsibilities and technical solutions. This is consistent with [Li et al. \(2021\)](#) judgment that HK's water governance has the characteristics of technocracy and government dominance. Meanwhile, the frequency of water resources protection, water saving, water supply, and water recycling in this study was relatively low. Within this water quality-related sample, demand-side measures were less visible. This is consistent with the findings in existing studies, which suggest that water managers may prefer to adopt supply-side measures such as expansion projects, development of new water sources, and improvement of infrastructure, while they pay less attention to price management, water use behavior, and demand regulation ([Liu et al., 2024](#); [Vidal-Lamolla et al., 2024](#)).

There are limitations of the research. The study used the proceedings of the HK LegCo as the main material, which helps observe how policy issues enter the formal agenda; however, the discussion is not equivalent to policy implementation. The appearance of a tool in the meeting does not prove its actual effect. In addition, given the small and variable annual sample sizes, individual year-to-year fluctuations should be interpreted cautiously as descriptive variation in LegCo attention rather than as evidence of substantive short-term policy transitions. Future studies can combine government policy documents, budgets, and project implementation data to examine whether the LegCo's discussions are translated into specific policy inputs and environmental outcomes. Interviews with personnel from WSD and EPD, as well as community representatives, experts, enterprises, and environmental organizations, can also contribute to the understanding of policy formation and implementation.

Conclusion

Based on 112 water quality-related records of the HK LegCo proceedings from 2014 to 2025, this study examines changes in water-quality policy discussions in HK: policy tools, policy issues, and their time evolution. The study found that command and control were the most frequently mentioned category, followed by public information, participation and collaboration, public investment, and economic incentives. The discussions shifted from a predominant focus on administrative regulation toward a combination of multiple policy tools. This shift does not indicate a simple replacement of one tool by another but rather a broader combination of policy tools. Moreover, water pollution, water infrastructure, and sewage treatment constituted the main policy concerns in the proceedings during the study period, and relevant discussions have gradually extended to new pollutants, intelligent monitoring, extreme weather response, and marine ecology. In general, issues with clear responsibility boundaries and compliance requirements were more often directly linked to command and control in the coding. Issues related to engineering construction and technological improvement were more often directly linked to public investment and economic incentives, while issues involving behavior guidance or multi-actor cooperation were more often directly linked to public information or participation and collaboration. The findings contribute to policy research by suggesting that diversification in the formal policy agenda can take the form of problem-related recombination, with different instruments linked to different governance problems in ways consistent with their regulatory, resource, informational, and coordination requirements. In addition, public complaints, councilors' supervision, and environmental emergencies were associated with short-term attention to specific issues in the policy agenda, while scientific research, technological development, and sustainable development goals were associated with broader issue coverage in the policy agenda.

Based on the findings, the study proposes the following policy recommendations. First, policy design should consider different combinations of instruments according to the characteristics of the problem. Command and control may be particularly relevant to issues with clear compliance requirements, while infrastructure, technological, and multi-actor issues may also call for public investment, economic incentives, public information, or participation and collaboration. Second, water governance reform should also pay attention to social and institutional conditions, not just the expansion of technical facilities (Tsani et al., 2020). The findings further suggest distinguishing public information from participation and collaboration in policy design, because one-way information provision and stakeholder interaction operate through different mechanisms.

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