

Article

## The Evolution of National Wastewater Management Regimes— the Case of Israel

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**Abstract:** In the state of Israel wastewater management (WWM), the legal responsibility of municipalities, was neglected for decades, resulting in pollution of the scarce water resources and the environment. This trend was reversed during the 1990s. This paper analyses the evolution process of the national WWM regime and its effect on WWM at the municipal level, and explains the paradigm shift. It is found that both the long-term neglect and the paradigm shift can be attributed to the central government's policies regarding WWM rather than to the local authorities.

**Keywords:** wastewater management; wastewater policy; regime evolution; transitions; Israel

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### 1. Introduction

Israel is burdened by a serious scarcity of fresh water, with currently *ca.* 180 cubic meters (CM) *per capita* per annum [1], and has been facing for some years a real water crisis. One would expect that the scarce water resources would be well managed and protected, but focusing on development, water has been mainly managed for quantity (resource-use) rather than for quality (resource-protection). Over-pumping and on-going pollution have resulted in severe deterioration of the water resources. Untreated or partially treated wastewater became the main source of pollution of surface and groundwater, as well as the environment [2].

In the state of Israel wastewater management (WWM) *i.e.*, collection, treatment and disposal, is the legal responsibility of municipal authorities [3], as is the case in many countries. While municipalities constructed sewerage systems to remove hazards from population centers from an early stage, the treatment and disposal components were widely neglected for decades [4]. This trend, however, was reversed during the 1990s when most municipalities began engaging in building advanced wastewater treatment plants (WWTP) [3].

Since the municipalities are legally responsible, the long-term neglect has traditionally been attributed to them, but a study concerning the processes for establishing WWTPs in municipalities in Israel, however, reveals that the central government's policies and agendas regarding WWM highly influenced WWM at the municipal level and can explain both the long-term neglect as well as the paradigm shift of the 1990s. The paper discusses the WWM regime from the central government's level to answer two research questions: (i) what was the evolution process of the national WWM regime in Israel and how did it affect WWM at the municipal level? and (ii), how can the paradigm shift be explained? The analysis refers to municipal WWM within Israel only; other important issues such as cross-boundary pollution are beyond the scope of this paper.

The theoretical approach for the analysis of the evolution process and the paradigm shift, in the paper, is inspired by both the Institutional Resources Regimes (IRR) and the transition theories. These are elaborated in Section 2. Sections 3 and 4 describe the evolution and the transition processes respectively, conclusions are drawn in Section 5.

## **2. Theoretical Background and Approach**

### *2.1. Institutional Resource Regime and Resource Regime Evolution*

The Israeli WWM regime evolution is analyzed within the conceptual framework of the IRR theory. While previous works mainly address water resources management [5-8] it is relevant to this case as WWM is considered in this paper as part of the overall water management and as a resource by itself.

IRR is a new approach that analyses the sustainability of resource regimes and their development over time. According to IRR, regimes evolve as a response to the change in the quantity/availability of the resource, and four types of regimes are identified: no-regime, simple-regime, complex-regime and integrated-regime [6]. Since they evolve from one another, they can also be referred to as 'phases' in the evolution process.

A central assumption of the theory is that resource regimes are identified as institutional systems that combine two components: (i) 'property rights' of the resource (ownership/uses); and (ii) the 'public policy' designed for the use and protection of the resource. Both components should be complimentary and must be considered, if institutional sustainability of the resource management, is to be achieved [5,9].

Property rights refer to ownership and uses/users of the resource. Concerning ownership, traditional types include state-, private-, common- and no- property [5]. Concerning uses/use functions of water resources, several can be identified, see for example, [6]. Public policy, in this paper, refers to the five elements of public governance as defined by Bressers and Kuks [10]: levels and scales of governance;

actors in the policy network; problem perception and policy objectives; strategy and instruments; and responsibilities and resources for implementation.

The regime types/phases and the shift between them are defined based on criteria of 'extent' and 'coherence' of property rights and public policy. 'Extent' refers to the scope of the uses/users that are acknowledged by the regime ("how many uses are regulated and protected by the regime?") and to the scope of the public policy elements ("how many actors, instruments, resources are involved in the resource management?"). 'Coherence' refers to the degree of coordination within and between property rights and public policy components of the regime ("are the different uses and policy elements well coordinated?"; "Is there a match between all uses as target groups of the policy system?") [5,8,9]. Based on that, simple regimes are characterized by low extent as they tend to recognize/regulate only one/few uses and usually are single-elements regimes: e.g., one governing actor, one problem perception, *etc.* The coherence can be thus characterized as medium-high. Complex regimes are characterized by increasing extent—as more uses are regulated, as well as policy system with multiple elements, for example, when more actors, instruments, resources, are involved. Increase of complexity, however, does not necessarily mean increase of coherence and complex but fragmented regimes are common. Therefore, complex regimes are characterized by higher extent but low coherence. The shift towards integrated regimes implies that both the extent and coherence are characterized as high (more elements, well coordinated) but requires a deliberate effort and will occur only when the relevant actors acknowledge that such integration is necessary to prevent further deterioration of the resource. Integrated regimes are considered most sustainable ones [5,6,9].

To conclude, resource regimes shift over time as a response to growing scarcity of the resource, and evolve from simple regimes (regulating single/few uses with single public policy elements, well coordinated) to complex but fragmented regimes (regulating more uses with multiple public policy elements, yet fragmented and not well coordinated) to—eventually with deliberate effort—integrated regimes (regulating all uses with multiple public policy elements, well coordinated).

Regime types/phases in water management can also be described as use-driven policies (facilitating the economic uses of water resources) or protection-driven policies (facilitating the ecological uses/functions of water resources). In this paper, use-driven policies are defined as policies that facilitate wastewater as a water resource whereas protection-driven policies are broadened to include protection of all relevant resources: public health and ecological uses of water.

## 2.2. Transitions

The shift between regime phases is marked by a transition. Transitions are stimulated by triggers. Kissling-Näf and Kuks [5] identify problem-related triggers and institutional triggers. Problem-related triggers can be sudden external shocks or a problem that increases slowly until it becomes too serious to ignore. Institutional triggers include, for example, a change in relationships between actors; the introduction of a higher administrative/political system (e.g., the EU); *etc.* Mentioned by Bressers *et al.* [9] and relevant to this discussion, are also demographic developments and the general policy process in related fields. The triggers are expected to affect motives and resources of actors involved.

A transition process, however, can also fail. In this case changes in one element would not be followed by changes in other elements of the regime, leading to failed or partial regime shift [6]. This implies that triggers, important as they may be, require favorable conditions for successful transitions. Bressers *et al.* [9] address preconditions as tradition of cooperation, joint problems, joint opportunities, credible alternative threat, and institutional interfaces, whereas Kampa and Bressers [8] after Kuks [7] refer to the institutional context in terms of power distribution, values, and perceptions of water issues in a nation. In this paper, the transitions observed in the Israeli WWM evolution and the presence/absence of favorable conditions explaining them, are analyzed within the conceptual framework of transition theory.

The transition theory refers to change processes in societal systems. It describes transitions as a long-term process resulting from co-evolution of cultural, institutional, economical, ecological and technological developments. A precondition is that several developments in these different domains interact and positively reinforce each other. The triggers for transitions can include slow social changes or short-term events. The theory identifies key concepts/tools: multi-stage; multi-level; and multi-change. The multi-change concept addresses transition management. The multi-stage and multi-level concepts are used to explain transitions [11] and are thus relevant to this discussion.

According to the multi-stage concept, a transition can be described in four stages: (i) a pre-development stage where changes occur under the surface; (ii) a take-off stage in which the state of the system begins to shift; (iii) an acceleration stage where visible structural changes take place rapidly through an accumulation of socio-cultural, economic, ecological and institutional changes that reinforce each other; and (iv) a stabilization stage where a new dynamic equilibrium is reached.

The multi-level concept distinguishes between three levels at which transition processes take place: macro-, meso-, and micro-level. At the macro-level influences are related to changes in the macro economy, politics, population dynamics, natural environment, etc. At the meso-level the regime operates and the dynamics are determined by dominant practices, norms, the organizations and policies that are often geared towards preserving the status quo. At the micro-level individual actors and practices deviate from the status quo by new ideas, initiatives, *etc.*

These concepts are combined to explain transitions. The take-off stage is reached when developments occur on the macro and micro levels and reinforce each other. It requires that different perspectives from different fields cross-fertilize and converge into more-or-less one paradigm, causing the regime to changes. In the acceleration stage, the regime has an enabling role through the application of capital, technology and knowledge (=resources). Dominant practices then change rapidly and irreversibly reach the stabilization stage, which represents another equilibrium [11,12]. While the theory refers to long-term processes and to introduction of innovations, it nevertheless inspires the analysis of the transition phases described in this paper.

### *2.3. Property Rights and Public Policy elements, WWM—the Israeli Case*

For the purpose of the analysis, some elements should be specified to the Israeli case. Concerning property rights, water resources—including wastewater effluent, are public property based on the 1959 Water Law, although an article in the 1962 Local Authorities (Sewerage) Law allows municipalities to sell effluent. Regarding uses, the following are hereby defined:

- WWM for the protection of health: since in Israel wastewater reuse for irrigation is a common practice, the traditional health aspect of protecting water supply systems and bathing waters is broadened to include prevention of health risks from irrigation with effluent;
- Wastewater for agricultural use: wastewater is managed as a water resource to increase water potential;
- WWM for the protection of fresh water resources: in Israel wastewater was traditionally discharged to the adjacent stream/river-bed if not used for agriculture, resulting in surface and groundwater pollution [1] and [13].
- WWM for the protection of the environment (ecological uses): (i) protection of maritime environment; (ii) rehabilitation of streams: in semi-arid Israel, all water resources are exploited [3]. Streams were utilized as well as used as sewage conduits for decades resulting in ongoing grave conditions of streams [13]. Recognizing effluent allocation for streams while restricting its quality can reverse this trend [1].

Concerning public policy, the five elements of public governance include:

- Levels and scales of governance; Israel has a single-tier system of local government with no regional/provincial governments [14] and is not a member of a higher form of governance (e.g., the European Union). Regional councils—federations of rural settlements—are considered a form of local government. Drainage boards, which are based on topographic features, are responsible for soil erosion and flooding but are not authorized to control sewage [13]. Therefore, the relevant levels are the local and central governments. However, with respect to WWM some other relevant bodies—although not a formal level of government—should be mentioned. Firstly, Associations of Towns for the establishment of WWTP. This inter-municipal cooperation is common since the 1990s. Such associations are established for the purpose of providing a specific service and have access to funds as a separate legal entity [15]. Secondly, regional/district planning authorities have the statutory power to approve construction of WWTPs. These are comprised of representatives of different Ministries, local governments and public sectors, and as such affect the issue from the local and central levels' perspective (e.g., within the framework of the existing legislation). Thirdly, River Authorities. The first River Authority was established in 1989, and others followed since then. Some of the River Authorities are also involved in related issues, such as destination of the effluent for reuse. These, however, are not considered in this paper as levels of government, but are rather addressed as 'actors' when applicable.
- Actors in the policy network; governmental (e.g., municipalities and different Ministries) and non-governmental actors, as elaborated in section 3.
- Problem perception and policy objectives; generally, WWM aims at: (i) protection of public health; (ii) protection of the environment and the water resources; and (iii) as a water resource (by effluent reuse) [16,17]. While the first two represent the historical development of WWM, the latter is relevant especially in arid/semi-arid regions. All are relevant in the Israeli case.
- Strategy and instruments; relevant legislation and its enforcement; command-and-control vs. market instruments, as elaborated in section 3.

- Responsibilities and resources for implementation; the different actors and responsibilities concerning policy implementation and the resources (financial and personnel) available to them.

#### 2.4. Methodology

The findings presented in the paper form a part of a larger study. The methodology used to collect data includes documents review, e.g., correspondences between position holders within relevant Ministries and other actors, minutes of meetings, relevant legislation, *etc.*, using the State Archive, as well as interviews with relevant stakeholders, e.g., Government officials, environmental Non-Governmental Organizations (NGOs), experts from the academy, and private consultants, since the establishment of the State. This is found suitable for the qualitative approach used in the research. At points, the author relies on dated literature sources. This is due to the historical perspective and is used for the purpose of the analysis.

### 3. WWM Regime Evolution

#### 3.1. Phase One—Wastewater as a Water Resource, 1948–1970

Upon achieving independence in 1948 and freed from the British Mandate Government's moratorium on immigration, the new state of Israel underwent rapid development and the population grew by 50% within a year and a half after independence. Israel had to cope with a major task of rapid development, which was a critical necessity in absorbing the massive waves of immigrants in a short period of time, providing housings and employment, and developing a strong economy. All development funds were being directed to solving these urgent issues. Water was essential for achieving this rapid development [2] and the State developed impressive national water projects such as the National Water Carrier and major regional systems during 1950s–1960s. This was aimed especially to support the very important agriculture sector, as elaborated in the following, and water has been managed for quantity rather than for quality [18]. These use-driven policies influenced WWM as wastewater was mainly perceived as a water resource, and sanitation and environmental issues were considered relatively low on the national agenda [19]. While municipalities constructed sewers to remove hazards from the population centers, treatment facilities and sanitary disposal, lagged behind [20].

#### Property Rights

*Ownership:* wastewater is owned by the public, as part of the national water resources under the 1959 Water Law (Art. 1 and 2). When the Law was promulgated it enabled municipalities to collect wastewater charges to cover the costs of constructing sewers, but not for constructing WWTPs. However, the 1962 Local Authorities (Sewerage) Law (Art. 15) allows municipalities to sell effluent to recover WWTP costs.

*Uses:* 'WWM for health aspect' (via the Sewerage Law) and 'protection of fresh water resources' (via the Water Law) were addressed by legislation but not enforced [2] and [21]; 'wastewater for

agricultural use' is the only use recognized by the dominant actors in the policy system in practice. Other uses (e.g., 'WWM for the protection of the environment') are not yet acknowledged by neither legislation nor policy-makers.

## Public Policy

*Problem perception and policy objectives:* The main policy objective with respect to WWM was managing wastewater as a water resource. In the new State, agriculture was an important economic sector but furthermore, it represented Zionistic ideologies of settling the land, the right to work own land in own country, *etc.*, and as such became a major national target [2]. Focusing on strong agriculture, water policy and management were very much dictated by the agricultural lobby and irrigation interests outweighed other uses such as protection of natural water resources [18]. The Water Commissioner—the highest authority in Israel concerning water management, was subordinated to the Ministry of Agriculture (MINAGR) and appointed by the Minister, thus heavily influenced by the agricultural sector, the largest water consumer and a very powerful sector, at the time. The MINAGR's prime interest was not to preserve the water resources but rather to promote the agricultural sector. Accordingly, wastewater was seen in this period primarily as an additional (cheap/free-of-cost) water resource to be utilized by farmers. Other aspects of WWM were mainly neglected. The public health aspect was addressed by the construction of sewers by municipalities to the satisfaction of central authorities, ignoring the treatment component, whereas WWM for environmental protection (including water resources) was non-existent. The policy objective in this phase was, therefore, of single-element;

*Actors in the policy network:* In this phase actors were only governmental. Apart from the municipalities, actors included the MINAGR (especially via the Water Commissioner), Ministry of Health (MINHLT), Ministry of Interior, Ministry of Employment (Housing Department) and the Treasury Ministry. The two actors directly involved were the MINAGR and the MINHLT, but although the only statutory authority to approve sewage works was in the hands of the MINHLT, in practice, this Ministry was smaller and weaker in comparison to the MINAGR [22,23], which became the dominant actor, and the two exhibit rivalries. The other Ministries were passive with respect to WWM and followed the lead of MINAGR. In an attempt for cooperation, the Sewage Committee—an inter-ministerial committee, was established in 1953 by the MINAGR. However, out of eleven Central Government members, six represented the MINAGR (including the Chair) and only two the MINHLT, and the Committee was to report to the Minister of Agriculture, reflecting the power imbalance. Furthermore, the Committee was mostly inactive thus ineffective. To conclude, small number and type of actors are involved with no real distribution of power or cooperation.

*Levels and scales of governance:* While both levels shared legal responsibilities, in practice there was a distinction between the sanitation (removal of hazards from population centers) and the treatment components. The former was seen as a municipal domain with little involvement of the central authorities, whereas concerning the latter, since effluent was seen as a national water resource, the decision-making power was very centralized with little consideration to municipalities' needs if they were not aligned with the central agenda. Municipal plans that did not include an element of effluent reuse were rejected, even in case of environmental pollution (for example, the costal town of Nahariya). The level of governance involved is, therefore, of single-element

*Strategy and instruments:* concerning legislation, relevant Laws are the Water Law and the Sewerage Law. The Water Law regulates the management of Israel's water resources, their preservation and their allocation for use, and designates the Water Commissioner vast authority to protect water resources [18], thus, regulates the uses of 'WWM for the protection of fresh water resources' and 'wastewater for agricultural use'. This Law provides the framework to protect water resources from wastewater pollution but was not enforced as the Water Commissioners in this period are biased towards the agricultural sector, as above-mentioned. The Sewerage Law was promulgated as a bottom-up pressure from municipalities, mainly allowing them to introduce wastewater charges although only for sewers and not for WWTP (illustrating the low priority given to the treatment component by central authorities). As such, it acknowledged the use of 'WWM for health aspects'. The Law, however, has several flaws. Firstly, it states that sewers (and later WWTPs) should be built to the satisfaction of the MINHLT, with no further specification (Art. 10 and 11); and secondly it does not specify any sanctions in case that its requirements are not fulfilled. The legislation, therefore, acknowledged only two uses, and furthermore—was not enforced. In terms of instruments, only command-and-control tools are used (although enforcement is lacking), resulting in single-element instruments.

*Responsibilities and resources for implementation:* concerning responsibilities, the division among the actors was unclear. Actors with formal responsibilities for WWM (e.g., the municipalities and the MINHLT) were over-powered by a less formal but dominant actor—the MINAGR. This affected also the availability of resources for implementation. Since WWM is the municipalities' responsibility, the resources should have been available to them, but this was not the case. Financial resources for WWTP were not available as separate national budgets were not allocated for this purpose. Since municipalities were not encouraged to raise private capital, they were dependent on indirect budgets (e.g., from the MINAGR). Municipalities mostly lacked the personnel resources needed for efficient WWM and only the large ones had access to such resources. Others relied heavily on the central level, impeding their ability to implement. The MINHLT was a weak and small Ministry with few financial resources, lacking its own budgets for sanitation. Other ministries such as the Ministry of Interior or Employment had their own financial resources but WWM was not their first priority and lacked the relevant personnel resources, relying heavily on the MINAGR. Therefore, although the responsibilities are seemingly shared, division is unclear and in practice the dominancy of the MINAGR is reinforced when it comes to resources for implementation.

## **Regime Analysis**

The 'extent' is low. Concerning property rights system, while two uses are regulated (health aspects and prevention of water pollution), in practice only wastewater for irrigation is addressed by policy makers. Internal coherence is low as the different rights of these uses are not coordinated, but rather the dominant one overshadows the others. The public policy system is mainly a single-element system, thus low extent. Its internal coherence is low as despite the formal attempt there is no/very little coordination among and between the policy elements (actors, goals, etc). The external coherence is low-medium because not all users are recognized as target groups of the policy system. The first phase



is therefore defined as simple: low extent of both uses and policy elements and low-medium coherence.

### **The Regime's Results (Effect on Municipal WWM)**

WWM in this period was characterized by a single problem perspective backed by a strong agricultural lobby, a centralized decision-making style, insufficient instruments and lack of enforcement. The focus was on use-driven policies. Municipalities were not pressured to treat wastewater and the few that initiated plans, were mostly rejected if the plans suggested advanced technical solutions or did not include reuse elements.

The approach led by the MINAGR was that effluent irrigation was of high priority and provided adequate low-cost solution for wastewater treatment. It therefore advocated the establishment of facilities for primary treatment, often only reservoirs, followed by irrigation with low-quality effluent. These facilities are considerably cheaper than advanced facilities and were thus considered suitable also from a financial point-of-view, and accepted by other actors (e.g., Ministries of Interior, Treasury, and Employment which had to allocate its own budgets in newly built housing complexes). However, farmers themselves were not always in favor of effluent irrigation as in this period water scarcity was not yet a pressing issue. Indeed, effluent irrigation was not common and only 4.5% of generated effluent was utilized in 1956. Furthermore, the low-quality effluent was used by the farmers only when needed, and in non-irrigation season surplus effluents was discharged into the nearest stream. The facilities themselves soon became a hazard source, as they were not properly maintained and upgraded. This state of affairs resulted in continuous discharge of untreated or partially treated wastewater to the environment and the pollution of water resources.

### *3.2. Phase Two—Simple to Complex: Failed Regime Shift; 1970–End of 1980s*

In August 1970 a cholera outbreak occurred. Almost 300 cases were reported, including 20 casualties. The outbreak was traced to consumption of raw vegetables that were irrigated with low-quality effluent. The outbreak caused a public outcry and had economic consequences on the tourism and agricultural sectors, putting heavy pressures on the Government. The relevant Ministries held urgent meetings and the health aspect of WWM received high priority. The Government made two decisions: a new inter-ministerial committee for WWM was established, and most importantly—an urgent loan was asked from the World Bank for the construction of wastewater infrastructure. The agreement with the World Bank was signed in 1972.

However, the outbreak had a short-term effect as soon after things went back to 'business-as-usual' with little change from the previous phase. The committee was comprised of the Director Generals of the relevant Ministries. The Director General of the Ministry of Interior was appointed as a Chair, but this was only a formal appointment. In practice, the Water Commissioner ran the committee [24]. The MINAGR was also the only Ministry with two representatives, maintaining dominance over the issue. The committee's task was to agree on related policy. To execute its decisions, an operative arm—the 'National Sewage Project' was established, headed by the Water Commissioner with the task of reviewing municipal plans, allocating budgets if approved, and supervising the implementation. The committee, however, convened rarely and did not execute its task. In the absence of guiding policy, it

was the operative arm that dictated the approach to WWM, via budgets [4]. Wastewater continued to be managed primarily as a water resource, affecting the approved technical solutions. The health aspect was yet again considered as secondary, environmental and water resources protection, non-existent.

The agreement with the World Bank had a potentially important role in improving WWM. Apart from providing budgets, it also required adjustments in relevant legislation and management practices on both financial (e.g., wastewater charges for WWTPs) and technical (e.g., facilities' maintenance, industrial wastewater pre-treatment) issues. Most of these, however, while formally introduced, were not enforced. The agreement with the World Bank ended in 1982, and WWM continued unchanged. The momentum was missed.

### **Property Rights**

*Ownership:* unchanged from the previous phase.

*Uses:* 'WWM for health aspect' and 'protection of fresh water resources' remained unchanged. The use of 'wastewater for agriculture use' was formally restricted via the 1981 Public Health Ordinance (wastewater treatment for irrigation), promulgated by the MINHLT.

### **Public Policy**

*Problem perception and policy objectives:* In the immediate period following the cholera outbreak, the policy objective was broadened and preventing health hazards received higher priority alongside wastewater as a water resource. Soon after, however, the latter remained the main objective as WWM continued to be dominated by the agricultural sector [22] and [25]. Several factors explain the prioritization of effluent utilization in this phase. Firstly, in drought years water allocation for agricultural use is cut down to accommodate the non-flexible water demand of the domestic and industrial sectors. Population and economic growth in this period resulted in increased water demands while the available fresh water resources remained unchanged, increasing the importance of wastewater reuse. Secondly, during the 1970s cotton became a very profitable crop. Since cotton can be irrigated with very low quality effluent (from a health perspective) it provided a growing market for such effluent and contributed to the continuous neglect of adequate wastewater treatment. WWM for environmental protection (including water resources) was still non-existent. The policy objective in this phase, therefore, remained single-element;

*Actors:* mainly remained unchanged. Concerning power distribution, while the MINHLT received an opportunity to play a more substantial role—it was missed and the Ministry remained a marginal actor. The Ministry of Interior became more involved due to its obligation towards the World Bank with respect to municipalities that received loans, but WWM was not its prime interest and it continued to follow the lead of the MINAGR. The Treasury Ministry should have provided 60% of the projects' cost according to the agreement with the World Bank and had a clear interest to reduce costs, following the lead of the MINAGR as well. Thus, MINAGR remained the dominant actor, via the Water Commissioner and the National Sewage Project [4]. A new actor—the Environmental Protection Service (EPS), was established in 1973 as a department in the Prime Minister's office. Following the Stockholm Declaration of 1972 the Israeli Government created a research arm in the

Prime Minister's office, which later became the core of the newly created EPS, influencing the perception of the environment and sewerage systems. The EPS was transferred in 1976 to the Ministry of Interior, mainly in order to affect local authorities' handling of sewage. The EPS had representatives in scientific forums of the National Sewage Project but no decision-making power [26]. Nevertheless, it should be mentioned as an important actor, as in fact it prepared the ground for the Ministry of the Environmental Protection that would be established at a much later stage, providing the Ministry with the professional expertise needed for the new tasks. It would also be involved in important environmental developments such as the establishment of River Authorities.

An attempt for cooperation can be identified again in the form of the inter-ministerial committee, but yet again MINAGR remained dominant and this committee was as inactive and ineffective as its former. To conclude, small number and type of actors were involved and there was no real distribution of power or cooperation.

### **Levels of Governance: Remains Unchanged.**

*Strategy and instruments:* concerning legislation, the Water Law remained unchanged and not enforced despite growing pollution from untreated wastewater and increasing water scarcity. The Water Commissioner could have brought criminal charges against polluters under the Water Law, but did not do so [2]. Reactions to concrete warnings from the National Water Supply Company regarding pollution of wells were delayed for years. This reflects the failure to restrict one use ('wastewater for agricultural use') in order to protect other uses' rights. The Sewerage Law was amended per the requirement of the World Bank allowing municipalities to introduce wastewater charges to recover WWTP costs—previously prohibited, thus further regulating the 'WWM for health aspects' use. Apart from this, the Law remained unchanged. New legislation was introduced in the form of the above-mentioned 1981 regulations for effluent reuse, restricting the 'wastewater for agricultural use' in order to protect public health (not water resources). The regulations, however, were too general (no specification of effluent quality required) and were thus difficult to enforce. Additional new legislation was the 1981 model Local Authorities By-Law (Discharge of Industrial Sewage into the Sewage System), promulgated by the Ministry of Interior per the requirement of the World Bank, in order to protect the treatment facilities as well as public health and the environment. This, however, was introduced as a voluntary by-law and by 1998 only 53 out of 265 local authorities have adopted it, while its enforcement is questionable. The legislation regulated more uses (although not all), thus its extent increases. Nevertheless, it mostly remained too vague, and not enforced. Instruments remained unchanged therefore single-element.

*Responsibilities and resources for implementation:* concerning responsibilities, the situation remained mainly unchanged and the MINAGR overpowered other actors with formal responsibilities. All actors, including ones with new responsibilities based on the agreement with the World Bank—consciously allowed the MINAGR to take the lead, as WWM is not a primal interest of any of them. Concerning resources, separate budgets aimed directly at wastewater infrastructure were available for the first time due to the agreement with the World Bank. These, however, were assigned to the Central Government (the National Sewage Project, chaired by the Water Commissioner). Municipalities remained dependent on the central authorities to access funds. The MINHLT remained weaker and

smaller in comparison to the MINAGR with no control over the new financial resources. Other Ministries continued to follow the lead of the MINAGR. Thus, although the responsibilities are seemingly shared, in practice the dominance of the MINAGR was reinforced when it came to resources for implementation.

### **Regime Analysis**

The 'extent' is slightly increased. Concerning PR system, alongside the health aspects and prevention of water pollution there is an attempt to regulate/restrict effluent irrigation. Other uses, however, are still not recognized, therefore the extent can be characterized as low-medium. The internal coherence is low-medium as in the immediate period following the cholera outbreak there is an attempt to coordinate the different uses but soon-after the dominance of one use, prevailed. Concerning the PP system, the extent slightly increased with the appearance of new instruments (new legislation) and resources (separate budgets). However, other elements remained unchanged therefore mainly a single-element system. The internal coherence is characterized as medium as despite the initial formal attempt, coordination among and between policy elements remained unchanged. The external coherence is low-medium because the mismatch between the systems remained unchanged. Not all use rights are recognized by the policy system which continues to be dominated by one main objective, neglecting other uses/objectives despite growing concerns.

The second phase is therefore defined as simple to complex: failed regime shift. While following the cholera event there is an increase in extent and complexity with an attempt to shift to protection-driven policies, this increase is short-termed and very soon WWM is back to be dominated by similar actors and objectives, as in the pre-cholera phase. The use-driven policies prevailed.

### **The Regime's Results**

Despite the opportunity presented by the cholera outbreak, the dominant policy makers continued managing wastewater in a short-term sectoral orientation, neglecting the sanitary and environmental uses, including protecting water resources. WWM, as part of the water resources management, remained in the hands of the MINAGR and the Water Commission. Prioritizing water use for irrigation and lack of enforcement of water-protection laws by the Water Commissioners [18] resulted in an approach for WWM that included low-cost, low-tech solutions e.g., stabilization ponds, followed by effluent irrigation, an approach that was known as 'agro-sanitation'. This was perceived as the most suitable approach, supplying cheap additional water source while providing an adequate solution for urban wastewater. From municipal point of view, the centralized style of policy-making reduced, de facto, the responsibility of municipalities as well as the resources available to them for implementation, causing them to rely heavily on central authorities. Municipal WWM plans that did not fit the 'agro-sanitation' approach, were rejected, with the exception of the big Metropolitan area of Tel-Aviv [25]. Furthermore, the lack of regulated base-line standards for effluent quality meant that any treatment was legally sufficient. This state of affairs suited the local governments as many used income from water and wastewater charges for other purposes especially when in fiscal stress [18]. All

these dictated the WWM solutions of this period, releasing municipalities of their responsibility and allowing them to continue neglecting WWM.

### 3.3. Phase Three—Paradigm Shift; End of 1980s/Beginning of 1990s <

In the end of 1980s and beginning of 1990s several factors aligned to influence policy makers to adapt a different approach. Firstly, the prevailing norm of discharging wastewater to the environment combined with population growth, resulted in growing pollution of water resources, too serious to ignore. Furthermore, in the mid-1980s the global cotton prices dropped and farmers shifted to more profitable crops, drastically reducing the demand for low-quality effluent. Secondly, the water crisis became acute due to consecutive droughts and resulted in major cut-downs in water allocation for irrigation. For the first time, farmers themselves realized that high-quality effluent that can be utilized for a wide range of crops is needed to provide a reliable alternative water resource to sustain agriculture. Thirdly, few health incidents related to wastewater pollution, raised public awareness thus pressure. In 1988 several poliomyelitis cases were discovered in the town of Or Akiva, causing public panic. Local municipalities in the area—neglecting to treat wastewater—were initially blamed, and while an investigation revealed at a later stage that this was not the cause—wastewater treatment already became a matter of public concern; pollution of water supply well as a result of leak from a sewage pipe resulted in 8,000 cases of dysentery in the metropolitan area of Haifa. Other less severe incidents also occurred. Fourthly, the collapse of the Soviet Block in 1989 opened the gates for Jews from the former USSR to immigrate to Israel. Over one million immigrants immigrated to a country of *ca.* five millions within few years, requiring housing and employment solutions. The Rabin Government, established in 1992, prioritized the infrastructure sectors, wastewater included, in order to accommodate the massive immigration. All these resulted in a paradigm shift regarding WWM as explained in the following.

#### **Property Rights**

*Ownership:* in this period a conflict between the Water Law and the Sewerage Law allowing municipalities to sell effluent became apparent. Since municipalities now invested in advanced WWTPs, many were interested in selling their high-quality effluent to their agricultural hinterland. Conflicts revolved around effluent price, as municipalities now demanded higher price per CM whereas the farmers, used to pay little or nothing, objected. Policy makers did not address these issues formally and adequately and in some cases, the Court was asked to intervene.

*Uses:* previously acknowledged uses were more efficiently regulated, and new uses were recognized. The uses of ‘WWM for health aspect’ and ‘wastewater for agriculture use’ are further protected/restricted with the introduction of the 1992 regulations for effluent standards (base-line quality) and the 1995 regulations for protecting water wells - further restricting effluent irrigation, this time with focus on protection of water resources (Public Health Ordinance 1940). ‘Protection of fresh water resources’ is more effectively regulated with the amendment of the Water Law to include effective sanctions. ‘WWM for the protection of the environment’ is now acknowledged, both in terms of protecting the maritime environment via the 1988 Maritime Pollution Prevention from Land Based Sources Law (following the Barcelona Convention, introducing the influence of international

agreements) and in terms of rehabilitation of streams. The latter was acknowledged not via legislation but rather via the newly established Ministry of Environmental Protection's (MINENV) general policy towards stream rehabilitation. As such, the Ministry regulates effluent discharge to streams to enable base-line flow when potable water is unavailable, by permits system and by requiring stricter effluent quality and other measures to insure suitable quality. The restriction of effluent discharge to streams was previously non-existent.

## Public Policy

*Problem perception and policy objectives:* WWM was addressed for the first time from a more holistic approach. More uses/aspects (health, environment and irrigation) were acknowledged in combination and the interest of both health/environmental protection and irrigation were aligned, as farmers recognized the need for high-quality effluent. Both the MINHLT and the Water Commissioner co-initiated the effluent base-line regulations [23] and [27]. Furthermore, the treatment component received the main priority for the first time and the reuse component was addressed separately. The policy objective is, therefore, multiple-elements.

*Actors:* New actors were introduced and the balance between previous actors, shifted. The most important new actor is the MINENV. Established in 1989 as a solution to a coalition crisis, it is the first independent organization with the sole interest of protecting the environment. It assumed the responsibility for protecting the water resources and soon became a crucial actor. The Ministry of Infrastructures, established in 1996, received the jurisdiction over the Water Commissioner and the Administration for the Development of Sewage Infrastructures (elaborated in the following). The Prime Minister's office (during the Rabin's government) was also an important actor, as the Prime Minister promoted improved WWM. The power-balance between the MINHLT and the MINAGR was shifting. Firstly, there was a drastic reduction of power of the MINAGR, due to combination of reasons. Agriculture lost its ideological status as well as its economic significance in the fast growing advanced market-economy (e.g., 17% of total employees in the agriculture sector in 1950 vs. 2.3% in 2007) [28], and with the Water Commissioner being transferred to the Ministry of Infrastructures, the link between water management and the agricultural sector was broken for the first time. At the same time, the authority of the MINHLT increased due to the effluent base-line quality regulations. New attempt for coordination is the Sewage Administration. It had a similar task description as the previous Committee but with one representative from each Ministry, and in contrast to previous committees, was subordinated to the Ministry of Interior [21]. Nevertheless, power struggles and rivalries continued, especially between the MINHLT and MINENV over division of responsibilities. Non-governmental actors became involved for the first time. NGOs became very influential actors although not formally by the regime but rather via the court and public awareness. Furthermore, new bodies related to WWM are introduced in this phase. Associations of Towns for the construction of regional WWTPs become common [15]; River Authorities are introduced starting 1989 and become involved in decisions regarding the destination and reuse of effluent, *etc.* Therefore, multiplication of number and type of actors involved but with little coordination.

*Levels of governance:* decision-making became less centralized and the local level more involved within the general decentralization process as responsibilities for more services were transferred from

the central to the local government. The local level was equally represented in the Sewage Administration. Therefore, multiple-elements with better power distribution and coordination between levels;

*Strategy and instruments:* Legislation includes new regulations/restrictions and amendments of existing legislation to better protect/restrict uses, as well as forceful enforcement. The 1992 base-line quality regulations, promulgated by the MINHLT, are considered a milestone of the paradigm shift. Introducing base-line standards, the regulations required municipalities to establish advanced WWTPs in order to comply, eliminating the common practice of low-tech solutions. They also provided the relevant authorities means for enforcement. Forceful enforcement is another crucial development and was one of the first actions taken by the MINENV. Firstly, the Water Law was amended to include substantial sanctions to polluters, including personal legal responsibility of Mayors/industrialists, imprisonment and high financial penalties. Secondly, Mayors/industrialists were being noticed regarding the requirement to adequately treat wastewater, and many were being indicted or threatened with indictment. Between 1994–1995 alone, 51 indictments were served [20]. Another mean of enforcement used by the Ministry, was refusal to populate newly-built housings. The massive immigration resulted in rapid development in many municipalities and had a major economical impact. Refusing to provide permissions put enormous pressure on Mayors. The Water Law was most recently amended in 2006. The MINHLT increased enforcement as well. Additional legislation/restrictions included restriction on wastewater discharge to the maritime environment via the 1988 Maritime Pollution Prevention Law; further restrictions on effluent with irrigation via the 1995 Public Health Ordinance (regulating conditions for drilling water wells), promulgated by the MINHLT and protecting wells from polluting activities including effluent irrigation; and stricter requirements for effluent quality if discharged to steams, by the MINENV. Concerning instruments, in addition to expanding the command-and-control instruments, market instruments were introduced. Grants were provided during 1993–1995 encouraging municipalities to apply for loans, and municipalities were encouraged (e.g., via grants) to privatize their water and wastewater services in order to improve their performance [29]. This was followed by the 2001 Water and Sewerage Corporations Law, encouraging municipalities to transform their administratively managed water sector to a more commercially oriented one. Therefore, multiple-elements instruments.

*Responsibilities and resources for implementation:* with the introduction of new actors, the responsibilities were further divided because responsibilities under existing laws were transferred to the jurisdiction of the new ministries, thus the complexity increased with further fragmentation. However, with the reduction in the power of the MINAGR and the increasing involvement of the MINHLT and the municipalities, the power-distribution for implementation became more balanced. Concerning resources, the budgets for wastewater infrastructure were significantly increased [26] and [29] (from 15–20 million NIS a year prior to 1992, to 180 million NIS in 1993, 250 million in 1994, 450 million in 1995 *etc.*). In combination with the availability of private capital—now being encouraged, financial resources were more available to the municipalities. Most municipalities had sufficient personnel resources or had access to such, via e.g., inter-municipal cooperation. The newly established MINENV, interestingly, began as a small ministry with little financial and personnel resources but managed in a short period of time to become the most important actor concerning the paradigm shift. Therefore, increased resources to the relevant actors.

### Regime analysis

The extent is characterized as high. Concerning PR system, more uses—including ecological, are recognized and all uses are better regulated. The internal coherence is low-medium due to the unsolved conflicts revolving effluent ownership and prices, and as coordination and mutual acknowledgment are still insufficient. The extent of the PP system also increases with the introduction of new policy objectives, actors, instruments, resources, *etc.* The system shifts to multiple-elements and becomes more complex. The internal coherence is characterized as low-medium as while there are attempts at coordination efforts and there seems to be better coordination within and between some of the elements (e.g., policy objectives, levels of governance), much improvement is still needed (e.g., including non-governmental actors in the policy network, reduced rivalries and improved cooperation). The external coherence can be characterized as medium as more uses are recognized as target groups by the policy system, although regulations need to be more effective and are yet to acknowledge all uses. The third phase is therefore defined as complex but fragmented with high extent and low-medium coherence.

### The Regime's Results

The beginning of the 1990s marked a shift in the Israeli WWM from use-driven to protection-driven policies, and advanced WWTPs were being constructed throughout the country. Indeed, in 2008, *ca.* 92% of wastewater was treated, with 55% of generated wastewater treated to secondary treatment and additional 32% treated to tertiary level [30] and [1]. Although the issue is far from being solved, with the remaining being insufficiently treated (mostly primary treatment) or untreated [30]—this is, no doubt, a substantial improvement in comparison to previous phases. Several factors can explain the shift (Section 4) but the new trend can be clearly attributed to the central government/authorities. If in previous phases, the centralized decision-making style combined with problem perception that ‘nationalized’ the effluent dictated low-tech solutions releasing municipalities of their obligation, in this phase, a combination of more balanced problem perception and power distribution, a shift to decentralized decision-making approach, increased enforcement and availability of resources, restored the authority of the municipalities and made it impossible for them to continue neglecting the matter. The three phases of the WWM evolution are summarized in Table 1.



**Table 1.** WWM regime evolution in Israel.

Regime phases	Description	Results
Phase one—simple regime (1948–1970)	WWM is dominated by one main user/actor: agriculture, with focus on use-driven policies. Public policy system is mainly single-element and is characterized by a single problem perspective: wastewater as a water resource, centralized decision making style, lack of enforcement and insufficient resources. Insufficient coordination among and between the different elements of the regime.	Low-tech, low-cost wastewater treatment solutions; continuous discharge of untreated or partially treated wastewater to the environment and pollution of water resources.
Phase two—Simple to complex: failed regime shift (1970–end of 1980s)	Following the cholera outbreak more uses are formally restricted/protected and the public policy system slightly expands with the appearance of new instruments (new legislation) and resources (separate budgets). In practice, however, the momentum is missed and soon after things go back to ‘business as usual’ and the dominance of one use: wastewater for agricultural use, prevails. Sanitary and environmental uses are further neglected.	Mainly unchanged. The centralized decision-making style combined with problem perception that ‘nationalized’ the effluent dictated certain solutions releasing municipalities of their obligation and resulting in continuous pollution.
Phase three—complex but fragmented (end of 1980s/beginning of 1990s <)	As a response to non-related pressures from different fields/levels, more uses are acknowledged and better regulated by the regime and the public policy system shifts to a multiple-element system with a more balanced problem perception and power distribution, a shift to decentralized decision-making approach, increased enforcement and availability of resources. A shift to protection-driven policies, is observed. While the regime becomes complex, coordination among and between the different elements remains insufficient, therefore: fragmentation.	Advanced WWTPs are being constructed throughout the country; the authority of the municipalities is restored and it became very difficult for them to continue neglecting WWM.

#### 4. Transitions in the Evolution Process

Why did the first transition attempt, following the cholera outbreak, fail while the second resulted in the paradigm shift? Triggers and conditions of both are analyzed in the following.

##### 4.1. Failed Transition (1970)

The trigger for the 1970 transition attempt is the cholera outbreak, via economical consequences and public outcry. This problem-related trigger forced policy makers to address the issue of WWM from a broader perspective. However, this had a short-term effect as once the outbreak was under control, all was forgotten by both the public and the Government and practices that were required by the World Bank were adopted formally but hardly implemented. The resources were affected, but not the motives. From the transition theory perspective, the cholera is a pressure from the micro-level. This, however, was not accompanied by parallel pressures/triggers, nor were there pressures from the macro-level. Furthermore, changes did not occur under the surface in the pre-development stage,

therefore while the cholera was a powerful trigger, it was not sown on a fertile ground. Finally, different perspectives from different fields did not converge into one to allow the take-off stage. Instead, the main actors chose to be fixed on the existing paradigm, prolonging the conflict between the health and agricultural uses and the dominance of one over the other. This can explain why the regime

(meso-level) did not change. The transition theory can therefore explain the failure of the trigger to set a transition in motion, as the right conditions for both multi-level and multi-stage concepts are not found.

#### 4.2. Successful Transition (End of 1980s–Beginning of 1990s)

Several triggers set in motion this successful transition. Directly related are: problem-related triggers (sporadic health hazards; increasing degradation of all streams and groundwater quality; water scarcity crisis; rise of the environmental movement) and institutional triggers (the establishment of the MINENV and the reduced power of the MINAGR). Indirectly related are: demographic developments (massive immigration from former USSR); the general policy process in related fields (the Rabin's Government policy of upgrading infrastructures) and global developments/events (the collapse of the USSR, the drop in world cotton prices).

These triggers explain well the successful transition if analyzed within the conceptual framework of the transition theory, as pressures from different fields and levels co-aligned to cause the regime to change. On the macro-level pressures include the collapse of the USSR, the drop in world cotton prices, and consecutive droughts. On the micro-level pressures include sporadic health hazards; increasing degradation of fresh water resources; water scarcity crisis; and the rise of the environmental movement. The institutional triggers (e.g., MINENV) can be described as inner trigger from the meso-level. Combined with the multi-stage concept, the transition can be explained as the following: in the pre-development stage changes such as growing public awareness, recognition of the agricultural sector for the need of reliable alternative water resource to sustain agriculture, *etc.*, start to occur under the surface so when pressures occurred, the relevant actors were prone to respond. The pressures - both from macro and micro level, co-aligned and reinforced each other, resulting in different perceptions to come together to a shared paradigm, and the take-off stage was reached. For example, only when both the MINAGR and MINHLT identified a mutual interest, the base-line effluent quality regulations were promulgated. In the acceleration stage, the policy system was altered and the regime enabled the shift by allocation of sufficient budget, forceful enforcement *etc.* Finally, the dominant practices indeed change rapidly and irreversibly. This explains well the conditions that resulted in the 1990s' paradigm shift.

## 5. Conclusions

In the State of Israel, wastewater treatment—formally the responsibility of local authorities—was neglected for decades, leading to environmental pollution and degradation of the scarce water resources. This trend was reversed during the 1990s and although to date the situation is far from being resolved, there is a substantial improvement in comparison to previous decades in terms of treated wastewater and its disposal. The paper analyses the Israeli WWM regime from the central government

perspective and reveals that the central government's policies and agendas highly influenced WWM at the municipal level, explaining both the long-term neglect and the paradigm shift. Since WWM is the responsibility of local authorities in many countries and as pollution by wastewater is a major remaining issue in many regions, the Israeli case may be of interest to them as well.

The Israeli WWM regime evolution shows three phases: simple; simple→complex (failed regime change); and complex but fragmented. The observed shift is from single user with focus on WWM for agricultural use (low-extent), and related single/few public governance elements, to a more complex regime that acknowledges additional users and is characterized by multiple public policy elements (increased extent and complexity). The analysis reveals that the long-term neglect can be mainly attributed to the dominancy of one user, thus actor, over the others, a dominancy that was derived from the status of agriculture in the new State. Receiving jurisdiction over water management while being the largest water user, the MINAGR managed wastewater as part of the national water resources, according to its use-driven policies. Furthermore, in the young State, water as public property was managed by a very centralized approach. The centralized decision-making style combined with the over-powering agricultural use, led to solutions that were dictated based on the agricultural interest but were far from protecting the rights of other uses. This resulted in almost non-existent authority of municipalities concerning this matter. Even a cholera outbreak did not fundamentally change this, and policy-makers continued with 'business-as-usual' approach resulting in massive degradation of the water resources and the environment. The Water Commissioner, being subordinated to the MINAGR, failed to protect the water resources by failing to restrict utilization of low-quality effluent for irrigation. The paradigm shift can also be attributed to the central government rather than to the municipalities and was enabled once more uses were recognized by the policy system and by a shift to multi-elements public policy system. A shift to a more decentralized decision making style, amendment of legislation, forceful enforcement, and allocation of adequate resources resulted in municipalities regaining their authority and taking action. The Israeli case reveals that although WWM is formally a municipal obligation, actions taken within the central policy system highly influenced WWM at the municipal level.

To explain the paradigm shift, the transition phases are analyzed. In the Israeli WWM evolution two transitions are identified: the first failed—resulting in unchanged circumstances, but the second succeeded, leading to the paradigm shift. Building on the IRR approach, the paper applies also the transition theory to analyze the transitions and the latter explains well both the failed and successful transitions. In the failed transition conditions were not fully met: there were no developments under the surface in the pre-cholera phase and while the cholera was a powerful trigger, it was not accompanied by parallel pressures, nor did it result in different interests converging into a shared paradigm. The regime, geared towards preserving the status quo, was not affected and continued managing wastewater in a similar manner once the pressure was eased. The successful transition, on the other hand, demonstrates well favorable conditions and explains the shift. Triggers from different levels/fields co-aligned to pressure the regime to change, and different perspectives converged to a similar paradigm for the first time. Changing the status quo became possible only when it was in the interest of all relevant actors (responding to pressures from different levels and fields), resulting in a broader and more holistic problem perception. Once the different interests aligned, alteration in other property rights and public policy elements followed, mainly recognizing more users and restricting

some to protect the others (restricting WWM for agricultural use to protect health, water resources and the environment), as well as providing the relevant instruments (amendment and enforcement of legislation) and sufficient resources for implementation.

Several lessons can be learnt: (i) Responsibilities for water resources management (including wastewater) should be awarded to an actor with no direct interest as a water user (e.g., the Ministry of Infrastructure, the MINENV). In the Israeli case subordinating water management to the MINAGR—the largest water user with a direct interest in wastewater as a water resource, explains well the long term-neglect of wastewater treatment. Once the responsibilities for protecting the water resources were transferred from MINAGR to the newly established MINENV sanctions under the Water Law were being used for the first time with crucial impact on WWM; (ii) Establishing an authority responsible solely for protecting the environment. In the Israeli case establishing the MINENV had a substantial effect on WWM as prior to that all other actors involved (e.g., MINHLT, MINAGR, Ministry of Interior) had other more primary interests to serve, neglecting protection of the environment and the water resources; (iii) Responsible authorities can and should use the authority given to them even if they are relatively weak and small. In the Israeli case the MINENV started as a small Ministry, established only to solve a coalition crisis, and had very limited resources available to it. Receiving authority that previously belonged to other Ministries, it could have continued along the same line of in-action and remain a marginal actor, but position holders (mainly the first Director General) were determined to make a change; (iv) When WWM is formally decentralized, as is the case in many countries, local authorities should be given the means/tools to carry out their obligation, whereas the central authorities should retain only monitoring and facilitating roles. In the Israeli case there was a mismatch between the two: local authorities were formally responsible but wastewater was managed *de facto* as a national water resource by a very centralized approach. This released municipalities of their obligation and explains well the long-term neglect. Once central authorities reversed this approach, demanded action by the municipalities on one hand and provided them with the relevant instruments on the other, municipalities responded accordingly.

Concerning future developments in the Israeli WWM evolution, despite the noted improvements, WWM is far from being satisfactory with *ca.* 15% of generated wastewater being insufficiently treated or untreated in 2008, continuing to pollute the environment. In addition, along-side the increase in complexity the system remained fragmented with inadequate cooperation. In the context of the IRR theory the transition to an integrated more sustainable regime is yet to occur. Such integration can be expected to promote better cooperation among the various actors to result in a shared and integrated problem perspective and thus coordination of strategies, instruments, and responsibilities/authorities, and can be seen as the way forward towards solutions to the remaining problems. Since this shift is not expected to be spontaneous, it requires a deliberate effort. Policy-makers need to take action towards better acknowledgment and involvement of all relevant actors, including non-governmental actors and the public in the policy system, as well promote better and more meaningful cooperation among them. Based on the poor results of previous coordination attempts, the results of such steps—if and when taken, are yet to be seen.

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