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INNOVATION

Sanitation and Sewerage Management:
The Malaysian Experience

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EXECUTIVE SUMMARY

Malaysia stands out in South East Asia as having made significant improvements in sanitation and sewerage management. The top-down strategy by the federal government, effectively over-riding the local governments, has produced quick results. The holistic approach adopted to manage centralised, community and on-site sanitation systems, put in place strong regulatory frameworks and a strong driver with a clearly defined role, and tasked the private sector to do what it does effectively. The national level policy, regulation and single service provider resulted in accelerated capacity building, creating a large pool of expertise in the country as well as a robust support industry.

The country has learned lessons from regulation, scheduled desludging, tariffs and cost recovery, and the incremental introduction of technology, all of which has produced mixed results. This has provided lessons for other places aiming to improve sanitation and sewerage management. Malaysia intends to forge ahead in this sector, charting the most appropriate and sustainable path for itself – providing another reference for cities that are developing their own sanitation and sewerage strategies.

Here, examples are provided of how septage management services are managed differently in two cities. First is Penang Island, which was part of the move towards privatisation and federalisation and where sanitation is managed by the national wastewater company, Indah Water; second is Kota Bharu, where sewerage and septage services are managed by a state government owned company Majaari Services.

CONTEXT

Malaysia is a country in South-East Asia. Most of its urban centres are small, except for the Kuala Lumpur conurbation. The country is rich in natural resources such as oil, tin and other minerals. There is a large manufacturing sector, and a substantial tourism industry.

Over the last 50 years, Malaysia has made tremendous economic progress and has invested in quality infrastructure. Poverty has been drastically reduced, and stands at 0.6 percent overall, and 1.6 percent for rural areas (Malaysian Economic Planning Unit, 2014). Sanitation and sewerage management, although still perceived to be lagging behind other sectors, has also seen dramatic improvements. Almost 100 percent of the population has access to



Box 1: Malaysia profile

toilets and safe sanitation. Nearly 70 percent of the population now has access to sewerage services that drain into off-site treatment facilities. Close to 20 percent use proper septic tanks (following standard design), while the remainder use modified septic tanks, pour flush or pit latrines. About 20–30 percent of the on-site facilities are regularly emptied and treated before disposal, while the rest are emptied on request.

HISTORICAL CONTEXT

Historically, Malaysia was an agricultural community, blessed with a good climate and fertile soils, and free from natural disasters. The local population lived in villages, coastal and riverine settlements, answering the call of nature in rudimentary toilets or in the open, and letting nature do the rest. The land attracted large numbers of immigrants from the region, and this led to economic activity and urbanisation. The arrival of European colonialists from the 1600s accelerated urbanisation. Rubber and tin were the commodities that drove the economy. Major urban centres arose around these production centres and ports. And with the urban sprawl came the attendant problems of waste disposal.

The incidence of waterborne diseases such as cholera, dysentery and typhoid was widespread, causing much suffering and death. By the late nineteenth century, local sanitation boards came up with mitigating strategies. Faecal matter was contained in pits or buckets, and carried away for safe disposal.

AFTER INDEPENDENCE IN 1957... WELL-CONSTRUCTED MULTI COMPARTMENT SEPTIC TANKS WITH FILTERS, SOAKAWAYS OR SOAK PITS WERE INTRODUCED

By the early twentieth century, the colonial authorities laid out piped sewerage in some of the larger towns, notably Georgetown (circa. 1930) and Kuala Lumpur (circa. 1940). The sewerage was limited to the inner core of the town, while the outer areas used bucket latrines and pit latrines, and practised direct discharge of waste. Most collected sewage and untreated night soil was discharged to a nearby river, or the sea. In rare cases, oxidation ponds were built to treat the sewage. The bucket toilets were emptied by night soil carriers, who sold the human faeces to farmers for agricultural use. When full, pits were usually

abandoned, and new pits dug. Where emptied, faecal matter was dumped in rivers, the sea or on garbage dump sites. Pit latrines often contaminated wells. The diseases continued.

Definitive actions after independence

After independence in 1957, the sanitation challenge was approached in a more systematic manner. In the larger towns, bucket latrines and other such systems were gradually phased out. Well-constructed two compartment watertight septic tanks, with a capacity of at least 2 m³ and the effluent either soaked away or passed through a filter, were introduced. Piped water supply became available in most towns, and flush toilets were common. A rural sanitation improvement programme provided proper flush toilets with pit latrines, located away from wells. All these steps effectively addressed the public health hazards of faecal matter at household level.

THE APPROACH WAS NOT A HOLISTIC ONE, AND SEVERAL SERIOUS SHORTCOMINGS EMERGED

Rapid development and emerging shortcomings

The 1970s and 1980s saw rapid economic development, driven by petroleum and oil palm. In most urban areas, housing estates and commercial complexes mushroomed, putting severe strain on the capabilities of local authorities. The federal government advised a policy requiring housing developers to build internal sewerage infrastructure to serve their developments. Small developments had to provide individual septic tanks, built to specifications, while larger developments exceeding 30 houses were required to provide a piped sewerage system, with their own sewage treatment plant. Grey water was also required to be included in the sewerage systems. This was a logical move, because it ensured sewerage infrastructure was provided for all developments, and it relieved the burden on the local government. However, the approach was not a holistic one, and several serious shortcomings emerged:

- **A logistical operational nightmare arose for local authorities**, resulting from the large number of sewerage systems being built by developers, with a wide variety of designs, systems, equipment and arrangements, and with little standardisation.
- **Local authorities generally lacked technical personnel with adequate knowledge of sewerage systems**, and the private sector was no better.

Moreover, there were no regulations or guidelines in place. Some systems were inherently defective in design, and the quality of the designs and the built infrastructure was sorely deficient.

- **Whole life costs and operability considerations were ignored.** Developers were driven to a large extent by commercial considerations. The options selected were therefore difficult to operate and maintain, or had high operational and maintenance costs. These facilities often developed serious defects soon after commissioning.
- **Neighbourhoods suffered overflows, odours, and nuisances** from these community treatment plants, which were located in close proximity to residential areas, especially when the treatment plants malfunctioned, which was often.
- **Serious issues of personnel, expertise and financial resources in the local authorities** resulted in large scale operational shortcomings, with most sewerage systems falling into neglect and disrepair. Theft and vandalism added to the problems, and as a result the sewerage infrastructure soon began to crumble. Discharges and overflows of raw or poorly treated sewage were widespread.
- **Enforcement of regulations was weak.** The Environmental Quality Act 1974 established the discharge standards for sewage effluent discharges to inland waters, but these were seldom applied. The fact that the offenders were local authorities may have been a factor.
- **Septic tanks numbers began to grow**, especially in small towns, because development was small scale.
- **Septic tanks began to malfunction, and sludge overflows were a major source of pollution**, because accumulated sludge was not emptied regularly. Septic tanks were generally well designed and built to specifications, but were desludged only on request, and there was no proper treatment of the sludge. It was often applied on land or discharged into the sea or rivers.

A few of the larger local authorities such as Kuala Lumpur and Penang obtained funding from the World Bank or the federal government, and implemented sewerage improvements. But most local authorities paid scant attention to sanitation, and any improvements that took place were driven by private developers. Local authorities generally neglected planning for this sector, and management was lacking too.

As a result, problems with the regulatory framework, institutional arrangements, capacity, awareness, financial and other resources, and overall management led to the deterioration of the physical infrastructure provided by developers.

In the meantime, a substantial percentage of the population continued to use poorly managed septic tanks, or even less satisfactory systems such as sub-standard septic tanks, pits or direct discharge, polluting ground and surface waters.

The result was a serious pollution of water bodies, including rivers, lakes and coastal areas. Water supply sources were being affected. Sewage was polluting recreational and tourism areas. The number of polluted rivers was increasing. The problem became very visible, forcing the federal government to take notice.

Federalisation and privatisation

The ineffective sewerage and sanitation management seemed incongruent with the rest of the country's infrastructure development. Save for a few major local authorities, most were not inclined to pay the attention that the sector needed. The obvious conclusion seemed to be that local authorities were ill-equipped to make the quantum shift that was called for.

Partly stemming from a private initiative by a group of entrepreneurs (which later became Indah Water Konsortium (IWK)), the federal government decided to federalise sewerage services in 1994, through the 1993 Sewerage Services Act. Provisions in the Malaysian Constitution allowed the Federal Government to legislate the transfer of jurisdiction. A regulatory department was set up at the federal level called the Sewerage Services Department. The operations were privatised under a 28-year concession agreement with Indah Water Konsortium (IWK). Indah Water (meaning Beautiful Water in Malaysian) Konsortium comprised local and foreign partners, including North West Water, a British water and sewerage operator.

INEFFECTIVE SEWERAGE AND SANITATION MANAGEMENT SEEMED INCONGRUENT WITH THE REST OF THE COUNTRY'S INFRASTRUCTURE DEVELOPMENT

The concessionaire operated in urban areas and its responsibilities included:

- Operation and maintenance of public sewerage systems
- Scheduled emptying of septic tanks
- Safe treatment and disposal of sludge
- Refurbishment of all sewerage infrastructure
- Planning and construction of new sewerage infrastructure.



Figure 1: Indah Water service area

IMPROVEMENTS

This federal government strategy took a top down approach, but most local authorities and states were happy to give up what they saw as a problematic role. All states, with the notable exception of the East Malaysian states of Sabah and Sarawak, the opposition-led Kelantan state and the city of Johor Bahru opted to handover these responsibilities to the federal government.

The initiative resulted in spectacular improvements in the sewerage sector, with substantial funds invested for the refurbishment, upgrading and operation of the dilapidated sewage treatment plants. Regulatory control was tightened. Sewerage catchment planning, incorporating land acquisition and reservation, was carried out. Developer guidelines were published, designs were scrutinised before approval, and construction was supervised, resulting in better quality developer built systems. Intensive capacity building programmes were carried out, and over the years thousands of technical and professional experts

were created. Indah Water set up a Technical Training Centre, offering a full-range of specialised training programs, both classroom based and hands-on, from planning, engineering design, right up to operator and skills training and safety. As a result, operation and maintenance of facilities became systematic and effective.

Improvements at city level

The approach adopted in Malaysia was one of uniform policy, regulation and service delivery across the area of coverage, which was almost entirely urban in Peninsular Malaysia. This section looks at the city level improvements that took place taking an example of a typical medium size city (Penang) which was part of the federalisation and privatisation drive, and contrasts it with developments in Kota Bharu, which was not included in the national privatisation exercise.

Penang Island

Penang is an island city in the northern part of Malaysia, with an area of 1050 sq. km and a population of about 700,000 (2016). It is highly urbanised and

has a strong tourism industry besides manufacturing and service industries. The population equivalent considering commercial, industrial and tourism contribution is about 1.4 million.

DEVELOPMENT OF THE TOURIST INDUSTRY CENTRED AROUND THE AREA'S BEAUTIFUL BEACHES AND NATURAL ENVIRONMENT CALLED FOR URGENT IMPROVEMENTS IN SEWERAGE MANAGEMENT

Sewerage development in Penang, started in the early 20th century under the British colonialists. Georgetown city centre was the first place to be seweraged, and the raw sewage conveyed to the sea via a sea outfall. Septic tanks were emptied only on request, and sludge was also disposed in the sea through the sea outfall. By the 1990s this was causing gross pollution of the coastal areas. The aging sewerage system experienced frequent collapses and overflows. At this time, rapid urbanisation, industrialisation and the development of the tourist industry centred on the area's beautiful beaches and the natural environment, called for urgent improvements in sewerage management. Despite lacking funds, the local authority carried out

these urgent improvements, using loans from the federal government. Planning was also carried out, for improved management of sewerage and sludge, and the land allocated for this purpose.

As part of the federalisation and privatisation drive, large budget allocations were made to refurbish and upgrade the sewerage infrastructure, including aging sewers and pump stations. A new centralised sewage treatment plant with a capacity of 800,000 people equivalent was built to replace the sea outfall at Jelutong. A second sewage treatment plant with a capacity of 650,000 people equivalent was also built to replace the old overloaded one in Bayan Baru in the south east of the island. Both incorporated sludge reception facilities to treat tankered sludge. An existing sewage treatment facility serving the tourist belt at Batu Ferringhi in the north coast of the island was refurbished and upgraded.

These massive projects, coupled with better management, and an awareness program, facilitated vast improvements in service delivery. Sewage overflows which had been a common occurrence, were eliminated. Desludging was done regularly and sludge was properly treated before disposal. Treatment plants performed much better, with compliance exceeding 90 percent.

Sewerage and septage services in Penang Island

The sewerage profile of Penang in 1994 and 2016 is shown Figure 3.¹ A large proportion of the population



Figure 2: Map of Penang Island

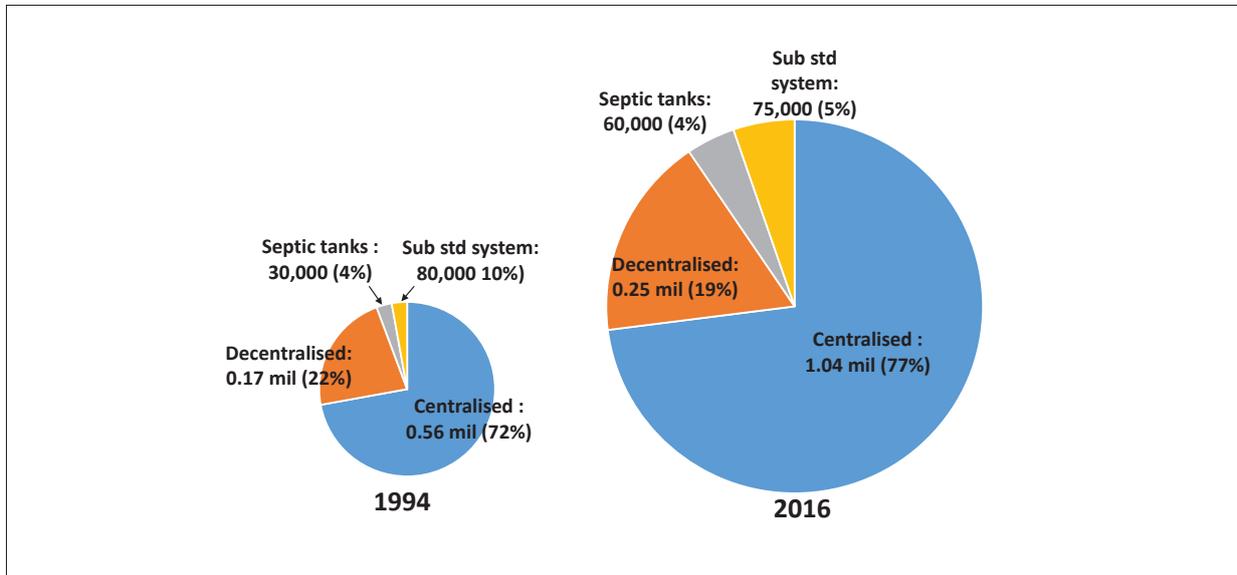


Figure 3: Penang sanitation/sewerage access profile

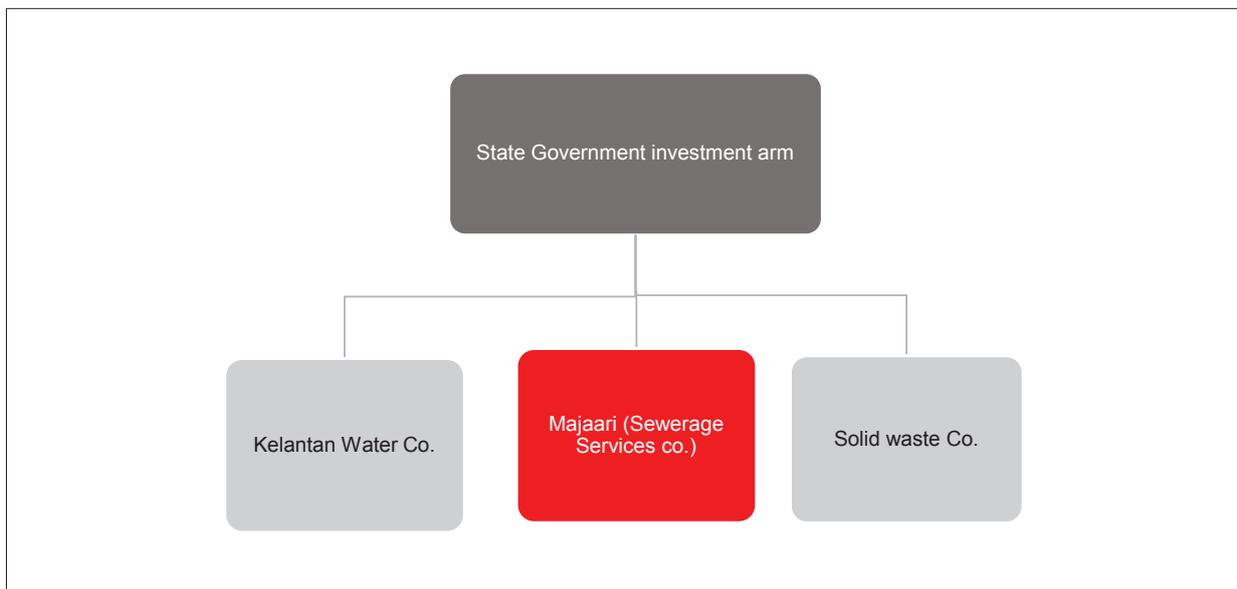


Figure 4: Structure of water and sanitation services in Kelantan State

is served by centralised sewerage, and the percentage of households using septic tanks and other systems is small. Three large centralised sewage treatment plants in Jelotong, Bayan Baru and Batu Ferringhi now serve more than 77 percent of the population. Indah Water Konsortium manages the sewerage in Penang, with a total staff of 149, including 15 in the sludge management section. The unit operates seven tankers, and most of the sludge is disposed in the reception facility at the Jelotong Sewage Treatment Plant where it is dewatered and the filtrate co-treated with the sewage. The Bayan Baru Sewage treatment plant also has sludge reception facilities.

Kota Bharu, Kelantan State

Kota Bharu is the capital city of Kelantan State in the North East of Peninsular Malaysia. It is the capital of

the medium sized, largely rural state. The city, with the adjoining peri-urban areas is around 400 sq. km, and has a population of close to 500,000.

When federalisation and privatisation of sewerage took place in 1994, Kelantan State opted not to participate. Sewerage management continued under the jurisdiction of local authorities until 2007, when the state government set up a company, Majaari Services, wholly owned by the state government's investment arm. The state's water supply company and solid waste management company is also owned by the state government, and are sister companies to Majaari, as shown in Figure 4.

Sludge services in Kota Bharu

Majaari operates throughout the state, across 12 local authorities. It has a small workforce of 38.

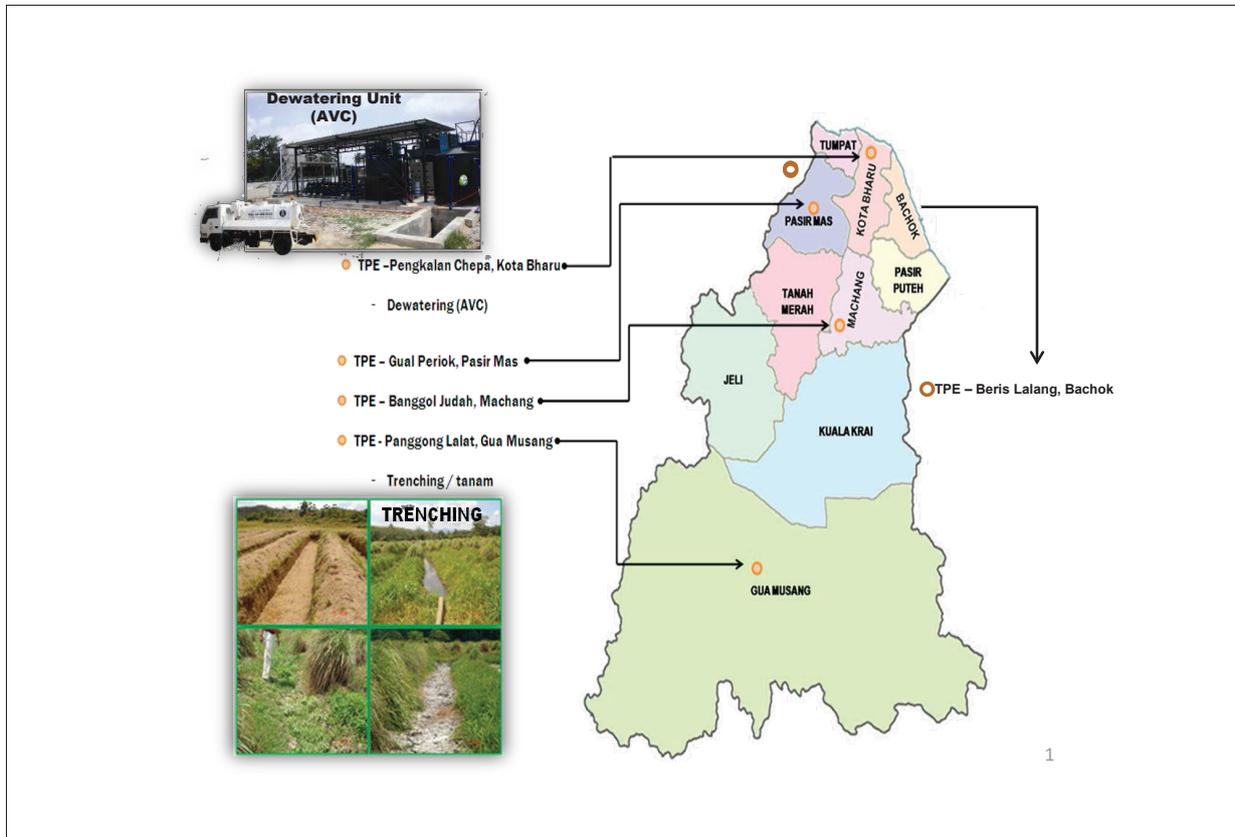


Figure 5: Kelantan sludge treatment and disposal facilities

The state has a total of 45,000 septic tanks and close to 70,000 pour flush or sub-standard septic tanks. About 10 percent are being desludged on schedule. The average monthly number of desludgings is about 290. Desludging demand has been increasing at the rate of almost 4 percent per year.

Sludge collected from Kota Bharu is sent to a semi mechanised dewatering unit where the filtrate is co-treated in an oxidation pond. In addition, there are four trenching sites in the state, in the more distant districts. Majaari has plans to increase its tanker fleet. It is also exploring reuse possibilities, especially composting and bio-char production. Being under state management, Majaari enjoys several advantages:

- Land issues are easily handled as land is a state matter. The company is able to obtain consent from state government to use sewerage sites for subsidiary purposes (such as siting of bill boards and telecommunication towers) and generate revenue
- Being the sister company of the water supply company, joint billing and collection synergies can be leveraged
- Being the sister company of the solid waste company, co-management of sludge solids and potential of co-composting opportunities exist
- Local authorities are also under state government, so the company is able to work with local authorities

to link scheduled desludging to licensing of commercial premises, and potentially use local government regulations to enforce desludging

Disadvantages:

- As a small state based entity, it lacks the resources and capacity of a large centrally managed entity such as Indah Water
- The company faces financial and operational constraints, and operates on a low tech, low cost basis, subject to affordability.

LESSONS LEARNED FROM THE SEWERAGE AND SANITATION SECTOR IN MALAYSIA

Co-existence of sanitation systems is essential.

The de-facto policies and philosophies of sewerage development accept the reality that a whole range of sanitation / sewerage systems are needed. These will continue to co-exist, and through specific demand drivers, the range will evolve, shedding the simpler and less effective systems and upgrading to better systems up the sanitation ladder. The concession agreement stipulates the targets for the eventual mix of seweraged and on-site (septic tank) systems for different categories of urban areas. Also required is the gradual phasing out of pits and pour flush systems in urban areas, and refurbishment of all sewerage systems to meet regulatory standards.

Perceived value of sewerage and septage services is important.

The nature of sanitation and sewerage as public goods means that after a certain point (usually outside the immediate vicinity of the household), the user does not perceive any added value, and the benefit is more to the community or larger environment. This was a key factor, which constituted a flaw in the model of full cost recovery from tariffs. The concession agreement intended to pass on full responsibility for capital and operating expenditure to the concession company, which in turn had to recover these costs from tariff revenue. In hindsight, a “user & beneficiary pays” model would have been more appropriate.

Information and awareness raising are crucial.

The model of charging users directly was introduced abruptly without adequate information and awareness raising. Most local authorities had never imposed direct charges for sewerage, and for septage emptying services, the charge was minimal and on provision of service. Also, there was no scheduled emptying, and the charges were very low, because septage was not treated, but simply dumped.

Willingness to pay must be established. Most people considered sanitation and sewerage the responsibility of local authority, already paid for by the local property tax. With federalisation and privatisation, users had to pay a separate monthly sewerage/septic tank charge, which was perceived as double charging. Sanitation and sewerage services are generally invisible to the user, which made the charging of tariffs even more unacceptable. The tariff of MYR 8.00 (USD 2.00) per month per house (introduced in 1994 and unchanged since then) was and is very low, and is certainly

affordable for almost all Malaysians. But the above factors, and the fact that payment could not be easily enforced, resulted in a very low willingness to pay. In addition, the tariff was heavily skewed with high tariffs for commercial customers. This caused a political backlash resulting in downward revision of the commercial tariff.

Scheduled septic tank emptying (1994–2008) is a must.

A major responsibility of the concessionaire was the scheduled emptying of close to 800,000 septic tanks (now 1.2 million). The users were billed MYR 6.00 (USD 1.50) per month per house (1994–2008) and their septic tanks would be desludged once every two years.

The immediate challenges were:

- **Creating a database of the locations of all the septic tanks**, starting with trawling through local authority records and later through painstaking house by house ground surveys
- **Scheduling emptying and issuing advance notice** to the householder, using this database
- **Acquiring new tankers.** Some tankers were transferred to IWK from local authorities, but many of these were decrepit and had to be scrapped and new tankers acquired.
- **Drawing up a sludge strategy** with immediate, short, medium and long term plans was required. Because there were almost no existing sludge treatment or disposal facilities, a sludge strategy with was drawn up. The immediate strategy involved co-treatment in oxidation ponds and other treatment plants. In the meantime, sites were identified for treatment/disposal, and approvals obtained from the environmental authorities.



Figure 6: Incremental improvements in sludge treatment technology

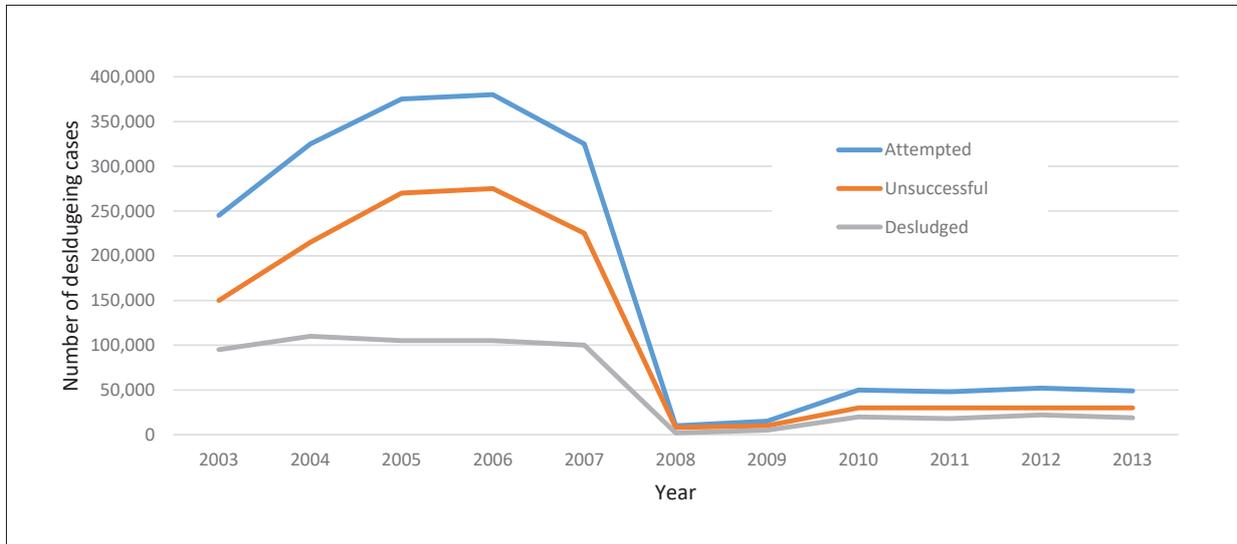


Figure 7: Septic tank desludging trend

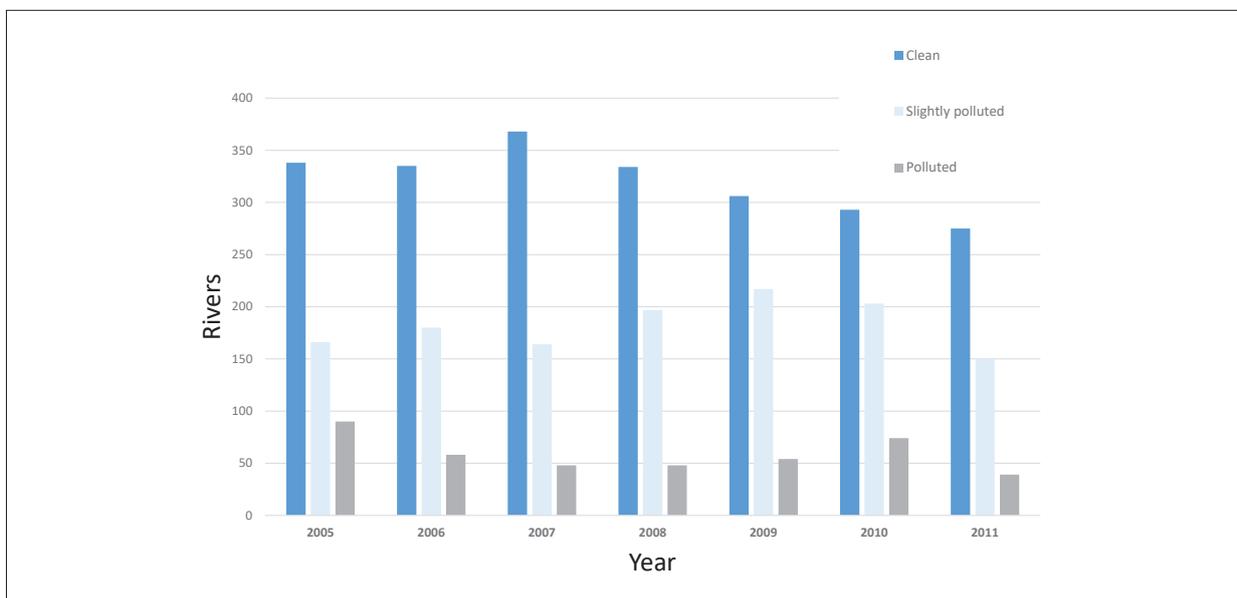


Figure 8: River water quality trend

- **Gradually upgrading systems.** Initially basic systems such as trenching were used, and gradually these were upgraded to drying beds, mechanical dewatering and full scale regional sludge treatment plants. The liquid portion was usually co-treated with sewage.
- **Focusing on removal, treatment and disposal,** rather than on reuse and resource recovery.

The considerable efforts of IWK resulted in a success rate of desludging of around 30 percent, which although low, was by no means a small achievement considering the lack of enforcement by the regulators. The reasons for the low success rate of scheduled desludging were:

- Owners refusal: a lack of awareness of how the septic tank functioned and why it had to be desludged

- Owner not present at time of scheduled emptying and therefore being unable to empty
- Inaccessible premises or septic tanks
- A total lack of enforcement

In 2006, the government passed the Water Services Industry Act, which came into force in 2008. This law shifted the responsibility of desludging to the house owner. House owners were obliged to get IWK or any licenced tanker operator, to desludge their septic tanks once every three years. However, sludge had to be brought to an approved facility. As a result, in 2008 scheduled emptying by IWK was stopped, leading to a huge drop in sludge removal and a significant decrease in river water quality.

The latest proposal being considered by the regulator is a volumetric tariff, which will be the same as the tariff for connected services (sewerage). Scheduled

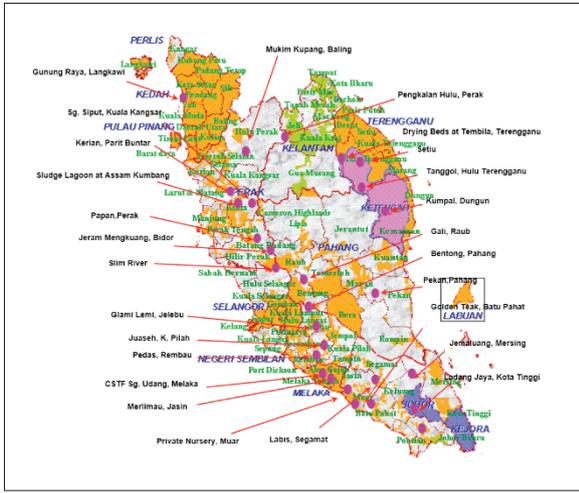


Figure 9: Sludge treatment facilities

desludging will be reintroduced with septic tanks being desludged once every three years. IWK will manage the scheduled desludging, and contract out part of this task to licenced tanker operators. With the volumetric tariff, improved awareness and more stringent enforcement, the proposal promises to be effective.

Today, IWK provides sewerage and sludge services to almost 24 million people nationwide. Its workforce of 3,336 is highly specialised, and consists of professionals and technical experts. Women play a prominent role, comprising 25 percent of the workforce, and 40 percent at the managerial and technical executive level, in this traditionally male dominated industry. The company operates through 21 unit offices (and 51 operating centres) covering 87 local authorities. It manages 6,488 sewage treatment plants (STPs), 62 dedicated sludge treatment facilities and 18,000 km of sewers.

While tariffs have remained stagnant, business costs have soared. Although operating costs and resources have increased in tandem, performance levels measured in terms of compliance to effluent standards (97 percent in 2015) and customer service (97.6 percent in 2015) have improved vastly.

CHALLENGES

IWK had a rough journey from the beginning, and several serious issues arose.

- Massive default on payment of sewerage bills followed the abrupt introduction of a commercial model that charged customer tariffs. Although the tariff was quite low (USD 2.00 per month/household) and affordable to most, the bulk of consumers believed sewerage services should be part of municipal services, for which they were already paying local taxes. The fact that sewerage services are generally not visible did not help.
- Massive refusals meant that only 30 percent of septic tanks were emptied, despite being scheduled. This was in part due to poor enforcement by the regulators, coupled with a lack of sludge treatment facilities and difficulty obtaining suitable sites.
- The financial model of the concession was faulty, and the scale of the physical infrastructure, work required, costs and other factors had been underestimated. The tariff was inadequate.
- Lack of political will to review the tariff, enforce collection and make the concession viable.
- With federalisation, the role of state and local governments shrank to almost negligible levels, causing them to be left out of the process.

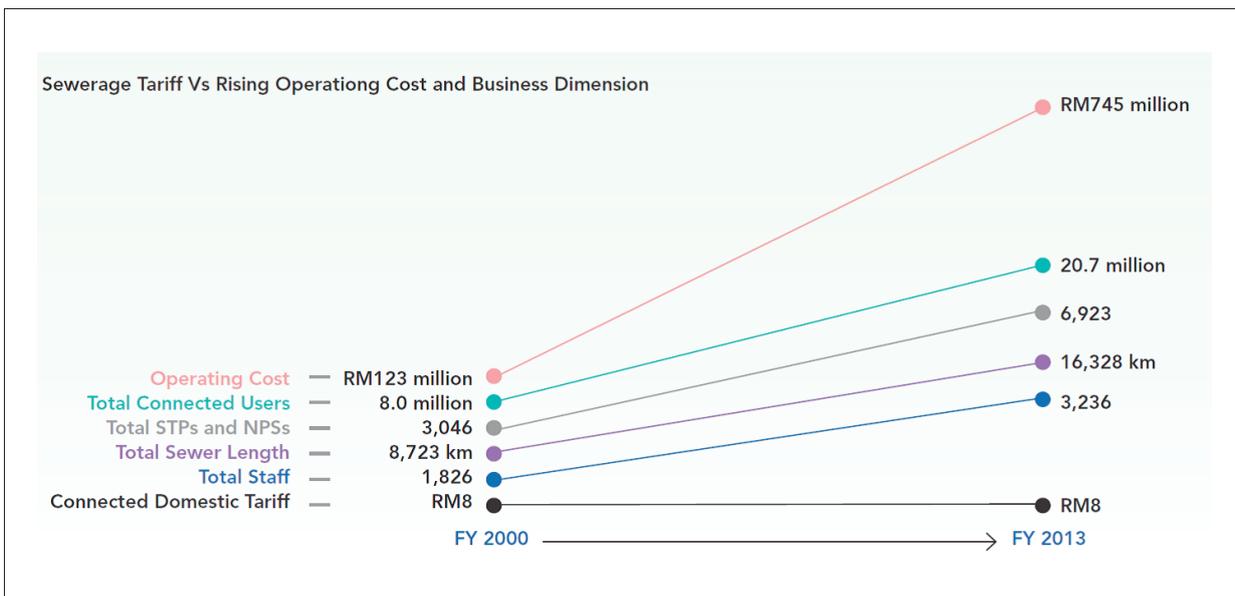


Figure 10: Indah Water business dimensions



Figure 11: Success factors

- Water and sewerage management were separated, with water supply remaining in the hands of state government.

As a result, Indah Water (IWK) ran into serious sustainability problems. While a lot of physical and management improvements took place, community acceptance was poor and financial viability was seriously lacking. This resulted in the federal government acquiring the entire equity of Indah Water Konsortium in 2000, and it continues to operate today as a government owned company. Public acceptance has improved, but tariffs remain low. The company regularly records an annual deficit of several hundred million ringgits, which is covered by the government in the form of a subsidy. As a government owned company, commercial considerations have generally taken a backseat.

In 2008, the government decided to decentralise sewerage management by integrating it with the state water supply companies. The Water Services Industry Act (WSIA) intends to gradually bring about the integrated management of water and sewerage under separate state entities, eventually resulting in a single volumetric water/sewerage tariff. The Act also envisages an asset-light model for the service licensees (operators), with the assets held by a separate entity, the facility licensee. This process is ongoing, but progress is very slow.

ACHIEVEMENTS

In spite of these problems that caused the government to reverse the privatisation, the sector has achieved great traction and momentum. This has been a resounding win. What are the achievements?

- **A very strong regulatory framework**, supported by institutional arrangements with clear roles for funding, asset provision, regulation, operation and management, as well as for various support roles.
- **Focused investment**, resulting in excellent infrastructure improvements, making many of them world class. Dilapidated treatment systems and sewers were rehabilitated and refurbished to good operating condition.
- In spite of its limited success, **the scheduled desludging regime has proven its value**. Sludge transport and treatment/disposal in a safe and orderly manner has been established.
- **The regulatory and institutional framework helped control developer investment**, with good quality infrastructure being provided by developers, which on completion was managed by IWK.
- **Systematic planning of sewerage and sludge management** ensured that the required infrastructure was provided in stages.
- **Development of systems and procedures for operation and management** of sewage and sludge management infrastructure.
- **Pervasive awareness was created** of the importance of good sanitation and sewerage management.

- **Training, skills development and capacity building has been largely successful** in creating industry capability.

What were the factors that contributed to the success?

- There was a very strong **driver** (the federal government) and political push for the whole process.
- While there was no written **policy** governing sanitation/sewerage, de-facto policies were recognised and institutionalised in laws, guidelines and procedures.
- Strong **legislative** arrangements gave legal basis to the initiatives. The Sewerage Services Act and its successor, the Water Services Industry Act and its various derivative legislation, provided a strong framework for the improvements.
- **Roles** and responsibilities of government, the regulator, operators, developers and others were clearly defined
- Federalisation resulted in **focused funding allocation** and massive investment in infrastructure improvements.
- **Private sector participation** helped develop guidelines, operating instructions and systems to bring the whole range of related activities, from planning, design, construction, operation and maintenance and overall management, to levels of excellence.

- **Appropriate technologies** were adopted with gradual upgrading, giving time and space for learning and adaptation
- Internal **monitoring and control** together with stringent regulatory oversight ensured everything was well controlled and weaknesses were identified and addressed
- Strong efforts by IWK in particular created **awareness and enhanced communications** among the community.
- **Training and capacity building** efforts, again spearheaded by IWK, created a large pool of people with the expertise and skill to support the industry.

On the downside, however:

- Although the federalisation approach brought quick gains, state and local governments despite being **key stakeholders were left out of the process**, giving rise to various issues.
- Sanitation and sewerage became federal government matters, while water supply remained a state government responsibility. This **broke the synergy** between water supply and sewerage management.
- The financial model of CAPEX / OPEX recovery from the tariff was seriously flawed, and there was a wide gap between revenue and costs. Even after CAPEX responsibilities had been assumed by the federal government, IWK needed a **huge shareholder subsidy** to continue to operate.

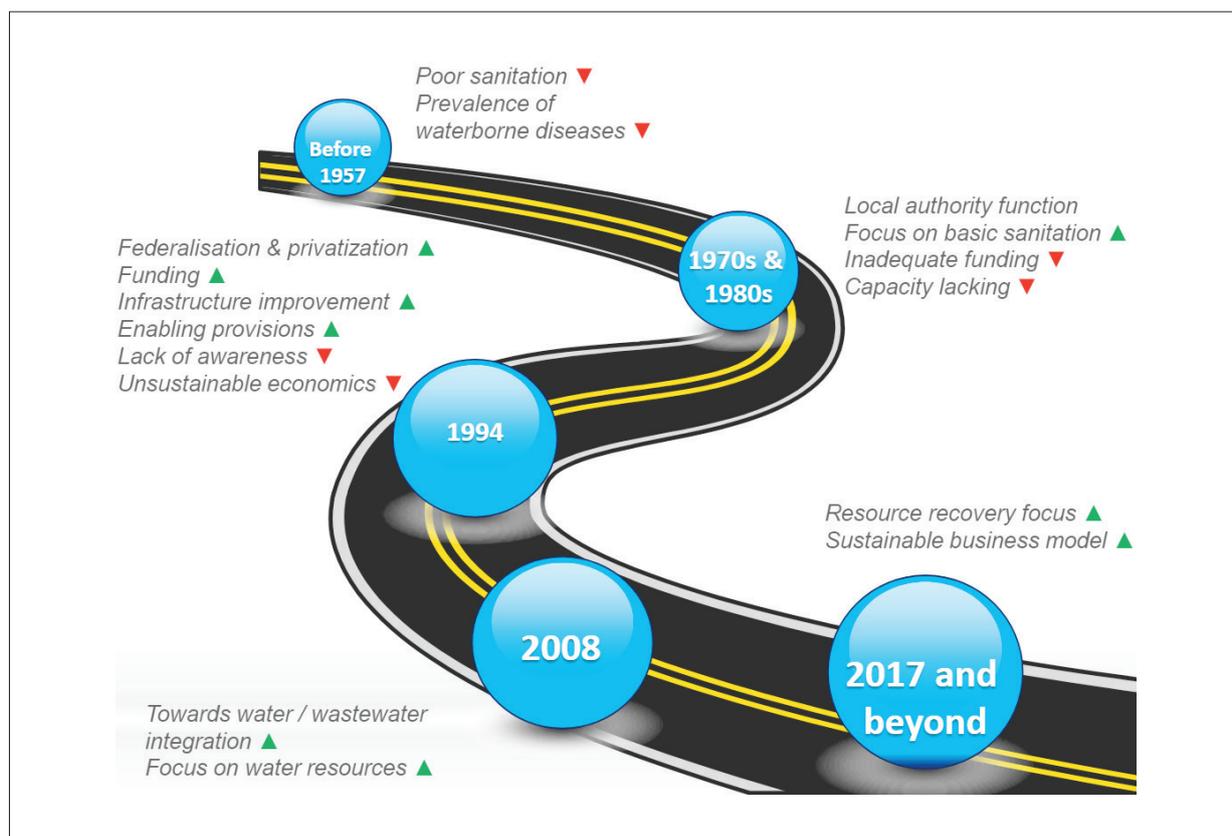


Figure 12: Malaysia's sanitation and sewerage journey

- **Public acceptance** of the tariffs was low and collection rates were poor.
- Developer investment in sewerage infrastructure far outstripped government investment. Coordination issues resulted in **wasteful investment** in many cases. Developer built infrastructure often suffered from **quality issues**.
- The policy of developer built sewerage infrastructure caused an increasing number of sewage treatment plants (STPs) to be built, most of them small and of various design, resulting in **logistical nightmares** for the operator.
- In the whole process, **opportunities for resource recovery** (effluent reuse, sludge biosolids reuse and energy recovery) were completely left out.
- The **well-intentioned scheduled desludging regime** met with failure due to lack of follow through enforcement.
- **Sub-standard systems and grey water** continue to be a major issue in many parts of the country.

OUTSTANDING CHALLENGES AND NEXT STEPS

Malaysia has come a long way in the last few decades in sanitation and sewerage management. Much has been achieved in terms of physical infrastructure, regulatory and institutional structures, capacity, education and awareness. However, shortcomings remain. Looking back over the last few decades, the way forward is clear: Malaysia intends to forge ahead in this sector by charting the most appropriate and sustainable path for itself.

THE WAY FORWARD IS CLEAR: MALAYSIA INTENDS TO FORGE AHEAD IN THIS SECTOR BY CHARTING THE MOST APPROPRIATE AND SUSTAINABLE PATH FOR ITSELF

- The coming years will see the sector **consolidating its primary roles** to continue to protect public health and protect water resources, while striving to provide nuisance free living space for the enhanced quality of life for the people.
- Priority will be given to **resource optimisation, reuse and recovery**.
- Attempts will be made to **define and coordinate** the roles played by various agencies in line with national goals.
- Public and private investment in the sector will be coordinated and **innovative funding** sourced, both for CAPEX and OPEX.
- **Appropriate waste management strategies** based on local needs will be formulated.
- Elements of **whole life cost, low-energy systems, standardisation and low carbon footprint** will be incorporated.

All these considerations have been incorporated into the National Sewerage Planning Policy and Strategy, which will form the basis of the National Sewerage Development Plan. This is expected to take the sector in Malaysia to even greater heights.

NOTES

¹ Estimated by author based on information from IWK

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ACRONYMS

CAPEX	capital expenses
IWK	Indah Water Konsortium
OPEX	operational expenses
STP	sewage treatment plant
WSIA	Water Services Industry Act

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