



PROCESSES

“Singapore combines two important aspects of water – the cutting-edge technology and demand management. [Singapore’s] demand management is at the forefront of the world. They are so successful with the “unaccounted-for-water”, which sets the standard for the world.”

H.E. Abdullah Al Hussayen

Minister of Water and Electricity, Saudi Arabia

In an interview with the BBC

PROCESSES

5.1 INNOVATION PROCESSES

5.1a How The Organisation Acquires, Evaluates And Implements Creative Ideas From All Sources.

INNOVATION FRAMEWORK

Innovation is one of PUB's core values, as the "I" in our VOICE values. Because PUB understands the importance for all staff to apply innovation in their work, PUB's Innovation Framework (see Figure 5.1.1) provides an environment for innovation to thrive. The framework is designed along three levels - Professional, Managerial and Operational - to encompass and to cater to officers from Senior Management to the support personnel on the ground. The four main stages within the framework that form the innovation cycle are namely, Generate, Evaluate, Validate and Implement.

Appropriate mechanisms are developed for each level of innovation (Figure 5.1.2). Those driving the generation of ideas include the six chief technologists and the Technology & Water Quality Office (TWQO) for the Professional Level; managers for the Managerial Level; and the OE Activists, Department Coordinators and I-Circles Team leaders for the Operational Level.

Employees who contribute to innovation are recognised in appraisals and through various rewards, awards schemes and their appraisal. Although there are three levels for innovations, ideas are allowed to flow freely, and ideas generated at one level can be channelled into the next.



Figure 5.1.1: PUB's Innovation Framework

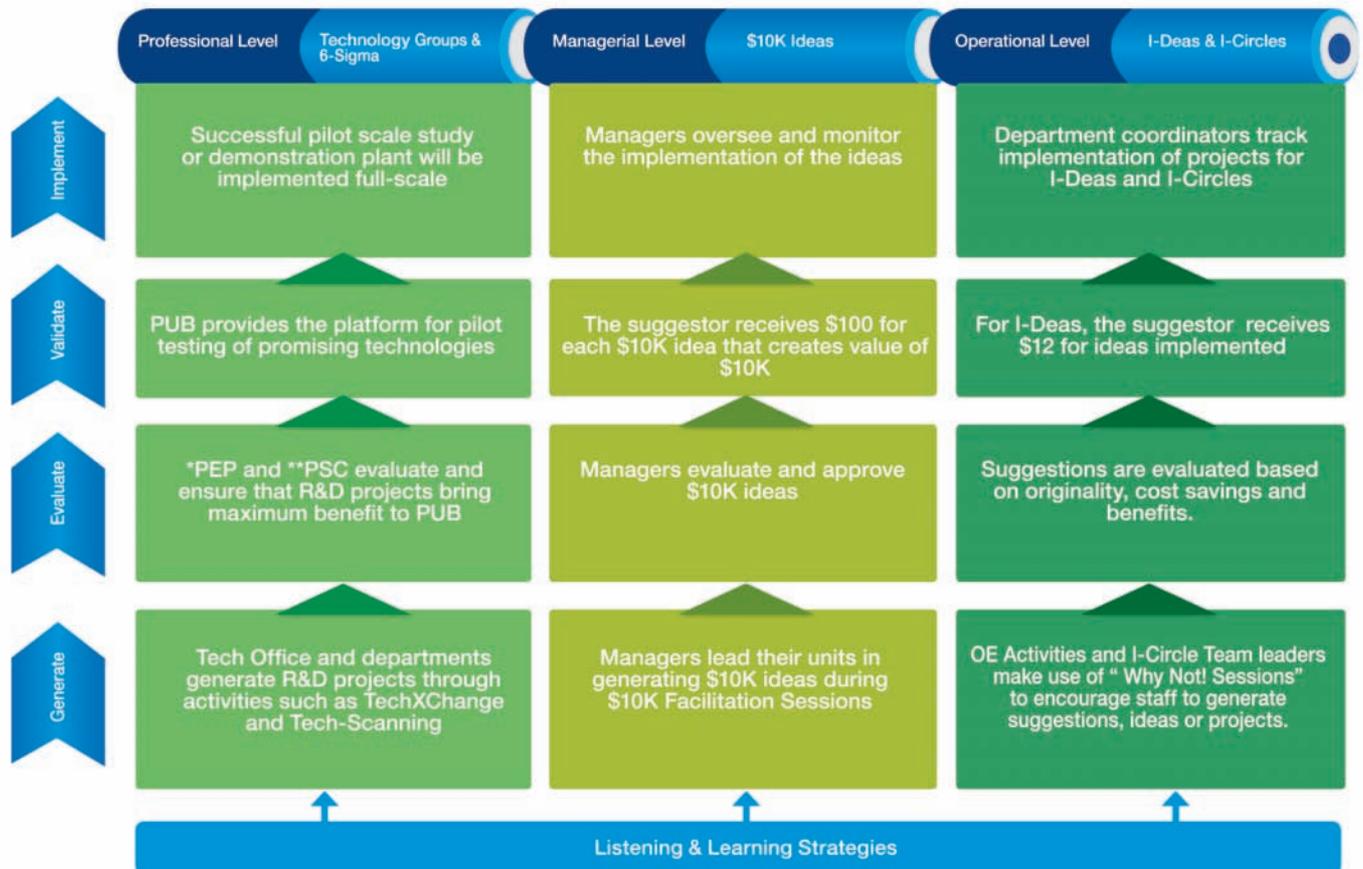


Figure 5.1.2: Innovation Process: Overview of How Ideas Are Generated, Evaluated, Validated and Implemented at Three Different Levels

* PEP - Project Evaluation Panel

** PSC - Project Steering Committee

5.1b How The Products And Services And Their Related Production And Delivery Systems Are Designed And Introduced. Include How Employees, Customers And Suppliers/Partners Are Involved In The Design Processes.

PROFESSIONAL LEVEL

Innovative ideas come from our R&D partners in academia, industry and research institutions or from PUB employees. Ideas accepted for R&D are developed between PUB employees (TWQO and project team) and our R&D partners. Workable ideas (mainly for product design) are tested and then implemented and/or commercialised. For example, the 16-inch RO membrane technology was developed in partnership with GrahamTek.

MANAGERIAL LEVEL

Managers are given the authority to take action in an environment that allows mistakes. Managers review their work processes and implement improvements to cut costs and inefficiencies. Each idea amounts to at least \$10K of savings within their unit.

OPERATIONAL LEVEL

Innovation at the Operational Level is guided by the SSS/I-Deas and WITs/I-Circles frameworks. Staff submit suggestions and I-Circles projects via the Innovation Centre in SHARoN (PUB's Enterprise Portal). Our employees have participated actively in these programmes as they are effective bottom-up channels for innovation. An example is the 10 Litres Bag used by residents during water disruption. 3,000 such bags were also shipped to Aceh during the South Asia Tsunami in 2004.



I-Circle Innovative Idea: 10L Water Bag. The I-Circle Team calculated that an average household requires about 10 litres/day of water for drinking and cooking.

INNOVATION AWARD

PUB was awarded the Singapore Innovation Award in 2006. It is the highest accolade given to innovative organisations in Singapore. The Award recognises and celebrates organisations whose outstanding innovation capability contributed significantly to business excellence.



PUB Winning The Singapore Innovation Award

5.1c How The Organisation Evaluates And Improves The Innovation And Design Processes.

PUB conducts regular and systematic reviews of the innovation process at the professional level. The review process involves analysis of the results generated from the innovation process. Based on the results and available feedback, improvements are suggested and incorporated into the innovation process, with the objective of generating more positive results. Figure 5.1.3 lists the review forums specific to each level. Some of the improvements made to the innovation process since PUB won the Singapore Innovation Award in 2006 include the adoption of Intellectual Property (IP) Policy in R&D Projects evaluation, approval, monitoring and review process and the introduction of the \$10K Overseas Award for an overseas study trip or conference on innovation.

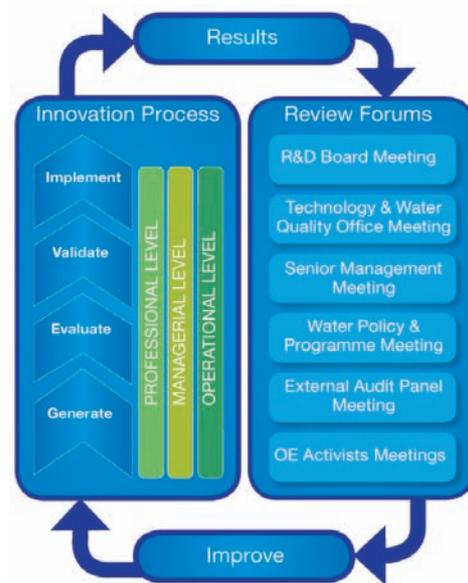


Figure 5.1.3: Review Process for the Innovation Process

5.2 PROCESS MANAGEMENT & IMPROVEMENT

5.2a How The Organisation's Key Processes From Production And Delivery Of Its Products And Services (Including Key Support Processes) Are Managed To Maintain Process Performance And To Ensure Products And Services Meet Customer And Operational Requirements.

In support of our Vision and Mission, PUB manages key and support processes in an integrated manner. Our key processes are categorised and aligned to our strategic thrusts of "Water For All" and "Conserve, Value, Enjoy". Figure 5.2.1 illustrates PUB's key and support processes.

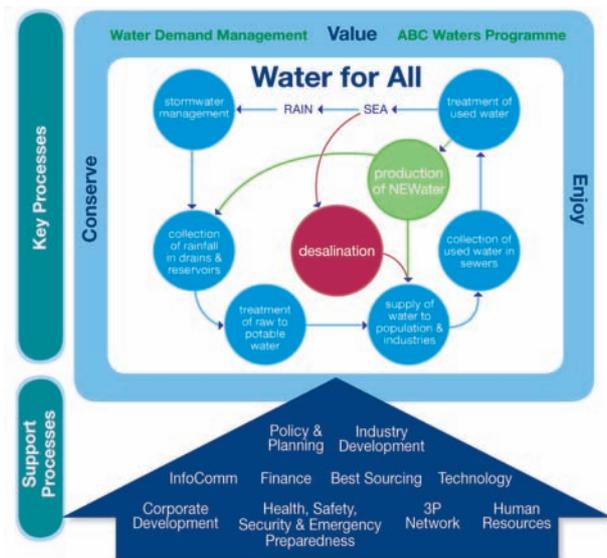


Figure 5.2.1: Overview of Key and Support Processes in PUB

5.2b Include A Description Of The Processes And Their Key Measurements And Requirements.

"WATER FOR ALL" PROCESSES

Stormwater Management

Our extensive drainage system channels stormwater effectively to prevent flooding. Singapore's flood-prone areas have been reduced steadily from 3,200 ha in the 1970s to 98 ha in 2007. The flood-prone areas will decrease further when the Marina Barrage is completed next year, as it will alleviate flooding in the low-lying city areas.

Reservoir and Catchment Management

PUB harvests rainwater collected in our network of drains, canals and 14 reservoirs. Today, about half of Singapore is water catchment. With the completion of the 3 new reservoirs namely Marina, Punggol and Serangoon Reservoirs by 2009, about two-thirds of Singapore's land area will become catchment areas. No other city in the world has harvested urban stormwater on such a scale.

Production of Potable Water

We treat raw water from reservoirs and rivers at 6 waterworks in Singapore and 3 in Johor to meet 100% of

Singapore's potable water demand. Through the use of both conventional and advance treatment processes, our water quality consistently exceeds WHO Drinking Water Guidelines.

Water Network Management

Treated water is supplied to approximately 1.22 million users through a dense network of 5,313 km of pipelines and 14 service reservoirs. Through effective network management practices, Singapore's water distribution system has one of the world's lowest incidences of leaks.

Collection of Used Water

Used water is collected through a sewerage network of some 3,250 km of sewers and 96 pumping stations with 180 km of pumping mains. 100% of the population has modern sanitation. PUB is also developing the Deep Tunnel Sewerage System (DTSS) to meet Singapore's needs for used water handling, throughout the 21st century.

Treatment of Used Water

Used water collected is then treated in 6 large Water Reclamation Plants. These Plants are mostly compact, covered and equipped with odour treatment facilities. In 2007, about 536 million m³ of used water was treated to the required standards for reuse or discharge into the sea.

Production of NEWater

NEWater is a significant breakthrough that PUB made in reclaiming water from treated used water using advanced membrane technology. Currently, four NEWater plants produce 15% of Singapore's water needs. When the fifth plant is ready in 2011, NEWater will meet 30% of Singapore's water needs.

Desalination

PUB commissioned Singapore's first municipal-scale seawater reverse osmosis (RO) desalination plant in September 2005. It is one of PUB's pioneering public-private partnership projects and one of the largest seawater RO desalination plants in the world.

"CONSERVE, VALUE, ENJOY" PROCESSES

Water Demand Management

To keep Singapore's water demand low, PUB adopts a multi-pronged approach of appropriate water pricing, mandatory water conservation measures, public education and efficient management of the water distribution system. Through community-driven public education programmes such as the Water Efficient Homes and Water Efficient Buildings programmes, home owners and building owners are encouraged to adopt good water saving measures.

Active, Beautiful & Clean (ABC) Waters Programme

This is an initiative to bring people closer to water so that they can better appreciate and cherish this precious resource. The programme aims to transform Singapore's water bodies into active, beautiful and clean waters, in line with the Prime Minister's call to remake Singapore into a City of Gardens and Water. A master plan was drawn up for the long-term development of Singapore's water catchments.

SUPPORT PROCESSES

Support processes play a crucial role in the effective and efficient performance of key processes. Support processes unique to PUB are as follows.

Policy & Planning

Our Policy & Planning Department undertakes integrated policy reviews and provides holistic, long-term systems planning to ensure long-term adequacy, reliability and security of water supply and used water management.

Best Sourcing

The Best Sourcing Department was set up to deliver projects and source for services at the best value for money. The department aims to facilitate greater private sector participation to competitively build, own and operate large water and used water treatment facilities.

Technology

One of PUB's strengths is our ability to leverage on leading-edge technology, innovation and industry partnership to achieve water and financial sustainability. A dedicated Technology & Water Quality Office was formed to oversee continual investments in R&D aimed at improving water supply, reducing production costs and managing water quality.

Industry Development

Above and beyond "Water for All" and "Conserve, Value, Enjoy", PUB has extended its role to establish Singapore as a Global Hydrohub and develop the local water industry. It also generates business and technology networking opportunities among water experts from around the world through the Singapore International Water Week (SIWW), the first international conference/exhibition in Asia to bring together global water experts and showcase practical water technology and business solutions. The inaugural SIWW was launched in June 2008.

3P Network

PUB adopts a 3P (People, Public & Private) approach to engage our stakeholders, to raise the awareness of the importance of water and take joint ownership of our water resource. A unique 3P Network Department was set up to cultivate 3P ownership and take the lead in "Conserve, Value, Enjoy" activities. Our Waters Programme was launched in 2005 to galvanise organisations and individuals to adopt our waterbodies and become Friends of Water. Many 3P partners, such as grassroots committees, private companies, government agencies as well as educational institutions, have signed up. Outstanding Friends of Water are acknowledged in an annual award known as Watermark Award. Schoolchildren, citizen groups and tourists visit the NEWater Visitor Centre, another pillar of our outreach programme.

To create a buzz about water, unique communications strategies are used to raise awareness of PUB's activities. These include PURE magazine, our Water Wally mascot, and the "ABCs of Water" infotainment game show.

Health, Safety, Security & Emergency Preparedness

Water is a critical and strategic national resource. PUB is, therefore, committed to ensuring the continual security & emergency preparedness of Singapore's water infrastructure. The Health, Safety, Security and Emergency Preparedness (HSSEP) unit was set up to provide advice on this. HSSEP is also tasked to ensure occupational health and a safe working environment for PUB employees. HSSEP monitors and audits the adequacy of protective security and water safety. HSSEP also ensures a high state of preparedness and effective business continuity plans by conducting regular exercises to deal with incidents or emergencies that may threaten water supply and safety.

5.2c How The Organisation Reviews And Improves Its Key Processes To Achieve Better Process Performance And Improvement To Products And Services.

REVIEW PLATFORMS

PUB employs various review platforms to evaluate process improvements at strategic and operations levels as shown in Figure 5.2.2. At strategic level, PUB reviews the effectiveness of existing strategies and processes. PUB adopts a multi-prong approach at operations level to ensure key processes are reviewed continually to achieve high level of process performance.

Platforms At Various Levels	Examples
Strategic level	<ul style="list-style-type: none"> • WPPM/PPM/SMM • Research and Development Committee • PUB Workplace Safety and Operations Committee • External Audit Panel (EAP), comprising an international panel of water experts • Department/Division meetings
Operation level	<ul style="list-style-type: none"> • Internal Audit Panel (IAP), chaired by Prof Ong Say Leong of NUS • HACCP, ISO 9001, ISO 14001 and OHSAS 18001 Certification Audits • QSM meetings

Figure 5.2.2: Review Platforms

IMPROVEMENTS MADE

In the course of reviewing processes and operations, PUB embarks on various R&D projects and test-bedding initiatives to evaluate new technologies, innovations and improvements. Numerous inhouse innovations and successful initiatives have been implemented. For example, the ABC Waters programme is the result of process review at strategic level to promote water stewardship.

5.3 SUPPLIER & PARTNERSHIP PROCESS

The Best Sourcing (BS) Department in PUB is formed with a mission to deliver water infrastructure and source for services for PUB at the best value for money. This is a unique setup as not many organisations have a department specifically focused on cost efficiency, demand aggregation and service outcomes. BS also facilitates greater private sector participation to competitively build, own and operate large water and used water treatment facilities. In fact, PUB is the pioneer in Singapore driving the Private-Public-Partnerships projects. A desalination plant and two NEWater plants have been allocated to the private sector under Design-Build-Own-Operate (DBOO) contracts ranging from 20-25 years. Prior to the calling of DBOO contracts, PUB has had extensive consultation with potential partners to understand the technical feasibility and their concerns on risk-sharing. This has enhanced DBOO contract specifications and improved our partners' capabilities. In 2006, more than 80% of PUB's total expenditure by dollar value was outsourced to the private sector through competitive tenders.

5.3a How The Organisation Identifies And Selects Its Suppliers And Partners. Include A Description Of The Key Performance Requirements For Suppliers And/or Partners And How The Relationship And Partnership Fit Into The Overall Strategy Of The Organisation.

Being the national water agency, it is our duty to identify (based on expertise) and select (using Government IM3B and Financial Manuals and compliance with technical requirements) our suppliers. PUB has also adopted a 3P (People, Public & Private) approach to engage our partners to raise awareness of the importance of water and take joint ownership of our water resource. Partners are identified based on their expertise and their capability to be in line with our corporate thrusts. Figure 5.3.1 shows how we identify and select our suppliers/partners.

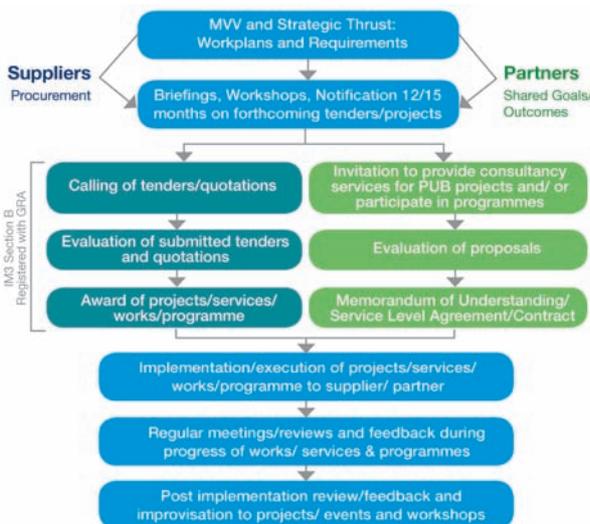


Figure 5.3.1: How PUB identifies, selects, reviews and communicates with Suppliers and Partners

5.3b How The Organisation Communicates And Ensures That Its Requirements Are Met By Suppliers And Partners And How Timely And Actionable Feedback Is Provided To Suppliers And/or Partners.

As illustrated in Figure 5.3.1, frequent communication exchanges between PUB and our partners and suppliers take place before, during and after the implementation of projects, services, works and programmes. Such communication takes place at 3 interaction levels: Strategic, Managerial and Operational (see Figure 5.3.2). Various channels at the before-during-after stages allow PUB to communicate our requirements to suppliers and partners. At the same time, we assess their performance through key performance indicators to ensure that our requirements are met. Through the same avenues, we give timely and actionable feedback to our suppliers and partners. In particular, for suppliers, we conduct regular meetings to ensure timely deliveries, completion and compliance with specifications as projects progress.

Levels	Who Are Involved (Pub & Suppliers/ Partners)	Channels of Communications
Strategic	• Senior Management	Before: • Tender Specifications
Managerial	• Project Manager	During: • Kick-off meetings • Progress meetings • Ground breaking ceremony / Project Launch
Operational	• Project Team	After: • Post implementation review

Figure 5.3.2: Communication Channels

More stringent safety guidelines and requirements (than those stipulated by MOM), are specified in our tender documents. At the start of any project involving construction, PUB will brief suppliers on the importance of safety and Earth Control Measures (ECM) and conduct ECM audits at construction sites. HSSEP Unit will also conduct regular construction safety audits.

5.3c How The Organisation Works With Suppliers And/or Partners To Understand Their Needs, And The Plans And Processes Established To Help Suppliers And/or Partners Improve Their Goods And Services, As Appropriate.

With the advancement in technologies and new processes, PUB is constantly working with suppliers/partners to generate new solutions and refine construction methods, processes and procedures. Dialogue sessions (PUBLinks, Forthcoming Tenders Briefings and Technical Seminars, etc.) are held with suppliers and partners to understand their concerns and share new developments in the water industry. Where our requirements are found to be wanting, we carry out reviews to amend the requirements without compromising our objectives. This is evident in the Marina Barrage project, where the contractor's alternative proposal generated significant savings of \$26 million in construction cost.