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Position Paper for Session 5B - *"Running Like Clockwork: Good Practices for Asset Management"*

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Background

1. Utilities that do not have strong asset management methodologies will be unable to manage risks holistically, leading to reactive decision making and an incident management culture that would drive up costs. This leaves them especially vulnerable and unable to respond well in times of unplanned-for challenges, such as the sudden and unexpected incidence of water pipeline breaks.

2. The fundamental purpose of the asset management process is to deliver the required service outcomes of a utility at the lowest **life-cycle cost**. A life-cycle cost approach – including upfront capital costs as well as ongoing operations and maintenance costs – is important in considering how to manage an asset. Although the approach gives insights on how apparent capital savings now could cost you a lot more in the longer term, it does not take into account **required service outcomes** such as (a) utility's regulatory obligations (e.g *Operating Licence, Customer Contracts*); (b) internal utility corporate objectives/policies; and (c) customers' acceptable level of product / service qualities. Utility Leaders and Asset Managers must have a strong understanding of both **life-cycle costs** and **service requirements** in making decisions such as whether to continue or dispose of an asset.

3. Another key component in asset management is the risk (probability) of failure, which affects the reliability and ultimately the performance of the asset. Having a robust **risk management** framework supporting the asset management process is important for an encompassing consideration of both performance and finance. Appropriate asset management strategies (*monitoring/inspection, maintenance, renewals, upgrade regimes*) should thus aim to achieve the **optimal balance between performance** (*availability, failure history, capacity etc*), **cost and reliability,** as shown in the illustration below.

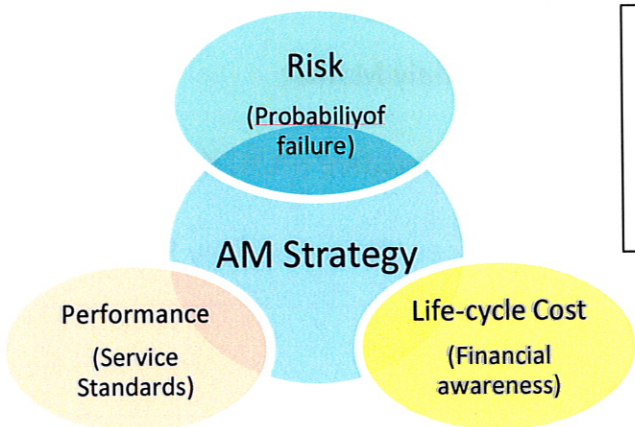

Figure: A robust asset management (AM) strategy requires balancing the tensions between performance (as driven by service requirements), life-cycle costs and risk (uncertainty)

4. To achieve a good balance, Asset Managers need to rely on appropriate **asset data and analytics** that manages and analyses both static information (e.g. pipe length, material, age, location, depth etc.) and dynamic information (e.g. pipe failure history, potential number of customers affected, ambient conditions etc.); as well as complement asset management plans with a constant **awareness of developments in technologies**, pursuing innovations that could help to reduce both performance and financial risks.

5. Efficient and effective provision of water utility services through good asset management therefore requires the following:

- clear alignment of asset management to the Corporate level of service objectives (*both internally and externally set*);
- good risk management;
- good information management (*collection and accessibility of necessary data*); and
- appropriate use of technology and innovation.

Each of these aspects is further elaborated on in this discussion paper.

Alignment of Asset Management and Corporate objectives

6. Asset Managers will have to assess **business trade-offs** at various levels of asset management decision making – between high-level corporate objectives, between asset programmes and between asset projects. One method of evaluating the trade-offs between the different levels of decision making is to break down the lifecycle of assets into discrete phases of activity. For example, IBM has a 8 life-cycle phase of Strategy → Plan → Evaluate/Design → Create/Procure → Operate → Maintain → Modify → Dispose.

7. Organizations need to ensure that **there is no disconnect between corporate objectives and asset management plans**, and that this alignment is clear across all levels of hierarchy: from upper management to ground staff implementing asset management initiatives. To facilitate the alignment of objectives, utility leaders can put in place processes that enable corporate planning documents (e.g *Statements of Corporate Intent, Strategic Development Plans*) and asset planning documents (e.g. *Strategic Asset Management Plans, Asset Class Plans*) to inform each other when they are being produced. Industry asset management planning guidelines such as the PAS-55[1] are also very helpful resources to guide asset managers in thinking about corporate policy.

8. Furthermore, utility leaders can also ensure that there is a robust communication and governance strategy around asset management, so that all levels of the organization understand the asset management "game plan", and how it fits the corporate objectives. For example, the Power Systems Business Group (PSBG) of CLP Power, Hong Kong believes in the value of aligning inter-department direction through effective collaboration and communication between Asset Managers and Service Managers. When developing asset management plans, PSBG has three stages of communication for its Asset Managers:

i. A Preliminary plan used for consultation with Service Managers to collect feedback
ii. A Draft plan, which is refined for more in-depth consultation
iii. A Final plan, which is communicated with the ground staff in road shows, to earn support for implementation

This alignment, as part of a greater asset management framework that was implemented over 10 years, allowed PSBG to achieve more than 90% reduction in customers minutes lost while responding to a 20% load growth.

9. Besides an internal alignment of objectives, utilities also need to manage customer expectations by clearly communicating the costs incurred to meet current service standards, and the additional costs needed to increase service standards. This is especially important for utilities

[1] The Publicly Available Specification (PAS) 55, published by the British Standards Institution

where water prices are determined by user pays and full-cost recovery principles: the asset management process should provide enough analysis to give confidence that the customers/community **have an ability to pay for the level of service established**. For example, the Water Corporation crafted a 50-year plan to deliver sustainable water and wastewater to Perth and its surrounding areas, where taking this whole life-cycle approach to demand and supply management had an impact on current-day operations. These plans were developed with extensive input from the community and industry, so as to have a strong engagement of customer expectations. The plans are expressed in the Corporation's "*Water Forever – Towards Climate Resilience*".

Risk Management

10. All utilities have many assets, a significant number of which are below ground. As cost constraints make it unlikely that robust condition assessments can be carried out on all of them, utility asset managers should have the capacity to assess which assets are their most critical ones in terms of failure consequence, and prioritize them for planned maintenance. Sound risk management processes will allow asset managers to decide between proactive maintenance or renewal, and run-to-fail strategies. For example, the Greater Cincinnati Water Works (GCWW) adopted a risk-based asset management approach, moving away from time-based asset management. Under the original approach, it replaced approximately 50km of piping every year, which cost about USD$40 million. Making replacement decisions based on risk allowed GCWW to possibly free up funds for investment in other areas, such as expanding service to new areas.

11. **A key pillar to a robust risk management framework is analysis on the causes of asset failure, which** helps to improve information on both the risk and consequence of failure. This in turn helps to strengthen specific asset failure response plans. In mid-2009, Los Angeles suffered an unexpected increase in high-profile water trunk line and main breaks. Several incidents, such as one which caused a pavement to collapse and damage a fire engine, drew extra media attention. The Los Angeles Department of Water and Power (LADWP) worked together with external experts with a diverse field of expertise, including material sciences, geotechnical engineering, hydraulics finance and economics and remote sensing. This allowed LADWP to better reassess the vulnerability of LA's underground pipe network. Knowing the consequence of failure helped to strengthen LADWP's asset management program, and reduce the risk of under-calculating the criticality of its mains for replacement.

12. Another key pillar in good risk management is the **analysis of current and future forecasted conditions** in the network, planning forward to ensure assets continue to remain sufficient. This requires the availability of good information and effective asset management tools for monitoring and analysis activities. The Water Corporation has developed the System Capability Forecasting (SCF) application to support the asset management decision making process in regards to monitoring, analysing and reporting asset performance and scheme growth. It utilises historic performance data along with forecasted future information[2] based on the best expected growth figures available to analyse against known measurement points such as capacity or pump design

[2] Future forecasted information relates to the ability to consider a number of asset operation parameters using past performance and then applying a preset algorithm that determines a trend line into the future. Examples of the parameters that are considered include sewerage pump station running hours on an annual and monthly basis, and volume pumped over the same timeframe.

flows (Triggers) to automatically determine scheme capability. The output of this information identifies the time in the future that specific solutions need to be in place to manage the risks associated with growth and capacity planning.

Information Management

13. Information/data is the life blood of an asset manager. Without this, it is not possible to have confidence in management decisions such as when to upgrade, when to replace, when to change a maintenance regime. This can include a number of key data types:

- Static data – usually a critical component of the asset creation process, where relevant data on the attributes of an asset (e.g. *Construction date, type, material, size etc*) are collected and stored in some form of corporate asset register
- Dynamic data – data collected highlighting the performance of assets or asset systems over time (e.g. *Flows, pressures, pump hours run, tank levels etc*), which can be used to assess need for system optimisation or upgrade
- Transactional data – this is the data provided as feedback on responses to work orders generated (e.g. *Failure/solution codes, hours/cost of jobs, location of failures etc)*

14. Processes need to be in place to **identify what your critical data needs are,** and then to ensure that this data is collected to an agreed standard and is **stored in a way that allows it to be easily retrieved for analysis and decision making**. Managers should ensure that they have the right data to meet their asset management needs and are able to identify key cost drivers/asset risks so that asset management effort can be applied to areas of greatest potential benefit. For example, in terms of capacity/upgrade decisions for changing demands, we will need data on growth in connected properties, on system pressures/flows, on inflows to wastewater treatment facilities or individual pump stations, data on per capita/per property consumption and per property wastewater flows.

15. **Robust documentation** of various water and wastewater systems is also an increasingly important aspect of asset management. Due to staff turn-over such as retirement of experienced workers and increased mobility of younger generation of employees, it is critical that asset system knowledge is well documented and not reliant on individual experience of workers. There is a need to eliminate, or at least minimise any reliance on '*local knowledge*'. Systems need to be in place to allow knowledge to be passed on quickly to get new people up to speed as soon as possible to mitigate the effect of likely higher staff turnover in future years.

16. Asset Managers should create a suite of **reports, analysis/prioritization models and decision support tools** to let our asset data guide decision-making and support staff experience and intuition. They will have to prepare an **asset inventory and system map** as a first step so as to know what assets you have in service, where they are and how they are connected. Also there is a need to integrate the **geographical interface system (GIS) solutions and** our work order management and modelling systems for ease-of-viewing of asset failure incidents, for aiding creation of hydraulic models etc.

17. Having robust documentation of data requires a lot of effort. For utilities just beginning to collect data to aid asset management decisions, **a gradual implementation of robust documentation should be considered as there will be resistance from both senior leadership and**

frontline staff. For example, the city of Wyoming, Michigan, applied an asset management program to its utilities using KANEW software in 2002. KANEW could be applied to determine future capital rehabilitation and replacement needs, calculating risks for lifecycle budgeting. Wyoming shared its biggest learning point is that the lack of historical pipe failure data significantly limited efforts to produce an accurate renewal and replacement capital plan. Frontline staff needed to be encouraged to consistently collect data, even if they do not see the immediate benefits of doing so To get senior management and frontline staff to see the benefits of the data collection, asset managers could demonstrate the benefits from pilot projects.

Innovation

18. It is important that asset managers **keep abreast of developments in technology** within the water industry, and also in other utility industries such as energy and oil/gas. This is important in areas such as condition assessment techniques, new equipment, predictive maintenance techniques etc. Developments in these areas can change the cost effectiveness of risk management strategies and allow more assets to be economically assessed. For example, pipe maintenance and repair could become increasingly costly as cities grow in density – this could mean that laying more expensive, but more durable pipes would be more cost-effective than laying cheaper pipes that have shorter expected life-spans and require more maintenance. An awareness of developments in technology, together with good information management, will help managers to continually assess the desirability of different maintenance strategies.

19. For example, a "run to failure" maintenance regime can be a cost effective approach when there is sufficient redundancy in the asset base (a single asset failure would not result in interruption to service). Many utilities undertake time based maintenance on their fleet of assets as an alternative to "run to failure" maintenance in order to reduce the risk of service interruptions. However, this can create great expenses to an organisation and also not consider cases when assets are working well and do not require any maintenance or servicing. Technological developments is thus needed to help utilities to collect information representing the operational "signature" of an asset, and then using that information to compare it against a known baseline signature representing expected performance. This provides the mechanism by which the condition of an entire family of assets can be assessed at a glance. For a utility with a large number of similarly-aged assets, such tools can provide timely information to direct maintenance effort when and where it is really needed.

20. A key issue to bear in mind when considering **innovation and new technologies is that it must be appropriate for the organisational circumstances/level of maturity**. The use of advanced technology might not always be the most appropriate thing – at times needing to '*walk before you run'*. For instance an investment of capital in advanced technology may create a situation where the organisation does not have the skill sets to operate and maintain the technology and so the investment is not used to its full potential or even worse can fail to achieve any desired outcome.

Closing Thought

21. Hopefully, the insights above underline the importance of viewing asset management as an encompassing business model, not just a program/assignment tasked to a group of individuals in a

company. In order to have good asset management, utilities need to develop robust risk management frameworks that are buttressed in rich data, a feature that is only possible with good alignment between planners and operational teams in the organization.

SUMMARY AND QUESTIONS FOR GROUP DISCUSSION

1. Alignment of Asset Management and Organisation's objectives

Tips on Aligning Objectives

- Know your tradeoffs well, so they can be easily communicated to all stakeholders
- Align internally, across all hierarchies
- Align externally, consulting the community in the planning process
- Use industry asset management planning guidelines to smoothen the process

a. How well does your organisation align its asset management with Corporate objectives? (E.g. is it part of annual work plan, budgeting and communication plan? Key component of medium term business strategy?)

b. Total life-cycle asset management can be complicated and messy if the different phases within a life-cycle are managed by different stakeholders. For example, the planning team might be more concerned about addressing future demand, while the operational team will be focused on solving immediate problems. How might water managers facilitate the information flow and dialogue between these stakeholders?

2. Risk Management

Tips on Risk Management

- Analyse causes of failure, and craft failure response plans for these scenarios
- Forecast future demand, and prepare infrastructure to meet it

a. How do you assess your asset capability and condition, and make decisions on renewal and maintenance?

- What risk management approaches are you using to address NRW?

b. How do you monitor the effectiveness of your asset renewal and maintenance strategies and programmes?

3. Information Management

Tips on Information Management

- Identify what information you need, and go collect it
- Develop Knowledge Management processes/tools to address ageing and increasingly mobile workforce
- Plan a gradual implementation of information management processes and data analysis – you will never have all the data you need

a. Does your utility have the appropriate information and tools to make robust asset management decisions and what are some of the issues/challenges that you experienced? E.g. processes and governance arrangements supporting the collection and management of this information, "single source of truth", systems are used to store your data etc.

4. Innovation

Tips on Innovation

- Keep updated on latest developments in technology
- Make sure that it is appropriate to the maturity of the organization

a. What processes do you have in place to keep abreast of new technologies and emerging issues related to water asset management?

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