Interaction Between Preventive Maintenance (PM) and Asset Management (AM)

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ABSTRACT

The Preventive Maintenance (PM) program within the Isaac Regional Council (IRC) Water and Waste (W&W) Directorate has been in operation for over three years. Of the 30 PM programs initially identified, 27 are currently active, with additional programs under development. The PM framework facilitates the systematic collection of asset-related data, including technical specifications, condition assessment outcomes and proactive maintenance recommendations aimed at preventing potential equipment failures.

Data gathered through PM activities supports multiple organisational functions. The Capital Projects Team utilises condition assessment results to develop short- and long-term capital works programs and to define project scopes based on proactive maintenance recommendations. The Data Integrity Team relies on operational data generated by regularly calibrated and properly maintained instrumentation. Among these stakeholders, the Asset Management (AM) maintains a particularly strong reciprocal relationship with the PM program, with each function informing and strengthening the other.

Prior to PM implementation, asset data within IRC's Computerised Maintenance Management System (CMMS) was incomplete and insufficient to support PM development or informed decision-making. Inconsistent equipment naming conventions across treatment plants and outdated information limited the practical use of asset records. Through the integration of PM and AM practices, asset data quality and usability have improved significantly.

This paper examines the interaction between PM and AM within IRC, highlighting the evolution of data quality, cross-functional utilisation, and organisational value creation, and discusses the future direction of this integrated approach.

1.0 INTRODUCTION

The Isaac Regional Council (IRC) Water and Waste (W&W) Directorate is responsible for the operation and maintenance of eight water supply schemes, six wastewater schemes and three recycled water schemes across eight townships covering approximately 58,000 km^2 and servicing about 22,550 permanent residents and 13,400 non-permanent residents (Council, 2021). As the largest asset custodian within IRC, W&W manages a substantial asset base recorded in its Computerised Maintenance Management System (CMMS), the Operational Asset Registry (OAR), which includes 17,545 water assets and a further 11,240 wastewater and recycled water assets. Water and Wastewater Treatment operations are an asset-intensive business, requiring a wide range of mechanical, electrical and instrumentation equipment to support operations and maintenance (DRDMW, 2021).

According to the DRDMW (2021), there are four common maintenance strategies.

- Preventive Maintenance: Maintenance activities planned according to how much service has been delivered; this approach can be appropriate for high-risk assets where the consequence of failure is unacceptable.
- Condition Based Maintenance: Inspection and monitoring to determine when maintenance intervention is required; this approach can be a very cost-effective approach to maintenance planning and can be extended to a full risk-based approach.
- Corrective Maintenance: Maintenance is carried out following detection of an

anomaly in performance; this approach can be cost effective.

- Reactive Maintenance: Unplanned reaction to an asset failure; this approach can be appropriate when dealing with equipment that has low impact on operations.

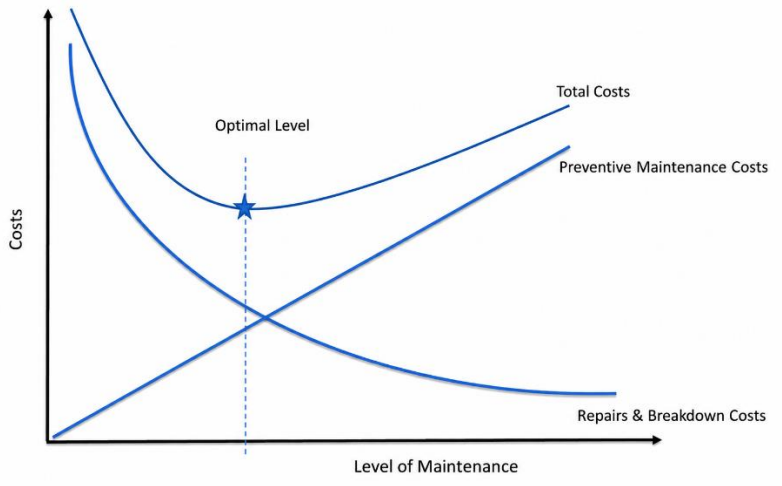

Figure 1 Relationship between maintenance level and costs

Figure 1 indicates that the implementation of PM is forecast to reduce repair and breakdown costs until the total cost reaches the optimal level (GFMAM, 2021). Prior to the implementation of PM, IRC W&W Directorate predominantly allocated resources to reactive maintenance and emergency breakdown responses. Unplanned breakdowns cause extended equipment downtime and increased operational pressure to maintain compliance and service delivery requirements.

In addition, the most comprehensive update of the OAR occurred in 2014, with only intermittent updates since then. This gap has resulted in reduced data integrity, inconsistent asset information, and limited practical use of asset records for operational and strategic decision-making. In response, IRC implemented a Preventive Maintenance (PM) program focused on treatment plant equipment. Over the past three years, PM activities have systematically generated valuable asset data, including condition observations, technical verification, and maintenance outcomes.

This collected data has significant potential to help various departments within the Directorate, especially Asset Management (AM). Appropriate asset management provides a clear understanding of what assets exist, the objectives for their management, and what actions are required to ensure the objectives are achieved. This paper demonstrates how PM interacts with various departments and how PM and AM are complementary in achieving organisational objectives.

2.0 DISCUSSION

This section describes case studies demonstrating how IRC PM interacts with other departments within the Directorate to contribute to organisational decision-making, planning, data integrity and asset management.

2.1 PM and Capital Project Planning

The Capital Projects Team undertakes both short-term and long-term planning processes to identify and prioritise infrastructure projects. Capital project planning requires reliable information to develop infrastructure renewal and upgrade programs over periods of up to 10 years. Regulatory reports, audit findings and risk assessments are key resources used to develop future capital projects. The Financial Asset Register (FAR) also contributes to capital planning through desktop analysis of asset remaining useful life (RUL).

Nevertheless, relying solely on the year of acquisition may not accurately reflect actual asset condition. Assets in aggressive environments may deteriorate faster than those maintained on a regular basis. In this context, PM is a key contributor in providing up-to-date information to underpin the capital planning. Periodic inspections and servicing provide time-series data showing how the asset condition changes over time. These trends assist in identifying factors that impact equipment condition. Recommendations and suggestions generated through PM help identify where resources should be allocated and which projects should be delivered within various timeframes. IRC PM provides reliable asset condition information captured using the IPWEA condition grading methodology ranging from Grade 1 to Grade 5 (IPWEA, 2006).

- Grade 1: Very Good Condition
- Grade 2: Minor Defects only
- Grade 3: Maintenance Required to Return to Accepted Level of Service
- Grade 4: Requires Renewal
- Grade 5: Asset Unserviceable

Condition assessment outcomes provide up-to-date evidence for project prioritisation and risk assessment processes. Management groups undertake risk assessments for listed projects to allocate high-consequence projects in the near term and lower-consequence projects in future years. The interaction between PM and capital planning therefore enhances evidence-based decision-making and improves the organisation's ability to allocate capital funding strategically.

PM data also supports the development of more accurate project scopes. Technical information such as equipment dimensions, model details, operational deficiencies and installation constraints can be verified during PM activities, reducing uncertainties during project planning. This improves the quality of tender documentation and reduces the risk of scope variations during project delivery.

2.2 PM and Asset Standardisation

Treatment plants in IRC evolved independently with limited asset standardisation and without a preferred equipment list, resulting in significant inconsistencies in equipment manufacturers, types and models. Although similar treatment processes are used across the region, a wide variety of pumps, analysers, flow meters, air compressors, blowers and generators are in operation. This lack of asset standardisation creates several operational challenges.

- Maintenance and operational complexity
- Reduction in interchangeability of equipment
- Additional staff training requirements
- Difficulty in securing critical spares
- Reduced confidence when operating unfamiliar equipment

Asset-related data indicates that water and wastewater treatment plants use a large variety of equipment to operate the plants. Despite using the same bulk chemicals, different types and sizes of dosing pumps are installed, making it difficult to secure common critical spare parts. Across the region's 32 pump stations, diverse manufacturers' submersible pumps are used, complicating standard spare parts inventory management. Online analysers are from 13 different suppliers while laboratory equipment is supplied by 7 different suppliers. IRC PM helps compare equipment performance, reliability and maintainability across the region. By analysing PM records and user familiarity, IRC can identify preferred

equipment that improves reliability and operational confidence. In addition, this information supports the development of asset standardisation strategies for future capital projects and operational renewals.

2.3 PM and Data Integrity

Reliable operational data is essential for water and wastewater treatment operations. Treatment processes rely heavily on monitoring and instrumentation systems, including flow meters, pressure transmitters, level sensors, online analysers and benchtop analysers. The accuracy of this data directly affects operational decision-making, process control and regulatory reporting.

PM plays a critical role in maintaining data integrity by ensuring instrumentation is periodically inspected, calibrated and maintained. Faulty or poorly maintained instrumentation can generate inaccurate operational data, potentially leading to incorrect process control, compliance risks and unreliable decision-making.

PM activities ensure operational instruments remain fit-for-purpose and accurate. Calibration and verification checks conducted through PM programs confirm that monitoring equipment continues to operate within acceptable ranges. For example, reliable pressure transmitter data allows operators to accurately determine the timing of filter backwashing to maintain acceptable water quality. Furthermore, periodic sampling and laboratory testing results generated in the laboratory using calibrated benchtop analysers are captured and packaged to meet regulatory requirements.

The IRC PM program works closely with the Integrated Management System (IMS) team to ensure that data collected through calibrated and verified equipment supports the safe and effective operation of water and wastewater treatment plants.

2.4 PM and Asset Registry

The Water and Waste Directorate is the largest asset owner within IRC, managing more than half of the Council's total asset base. Accurate asset information is therefore essential for maintenance planning, operational management and strategic decision-making.

IRC completed a comprehensive Operational Asset Registry (OAR) review in 2014. However, over the following decade, updates were primarily undertaken through individual or team efforts rather than systematic organisational processes. As each treatment plant evolved through operational modification and capital upgrades at different times, asset records gradually became outdated and inconsistent.

During development of the 27 active PM programs, significant discrepancies were identified between physical assets on site and asset data recorded within the OAR. Inaccurate, incomplete and inconsistent information reduced confidence in the use of asset data within the system, resulting in reliance on employee knowledge and experience. In many cases, IRC W&W lost historical maintenance and asset data because it was not recorded in the centralised CMMS system. Examples of data inaccuracies included the following.

- Incorrect asset names and inconsistent naming conventions
- Missing serial numbers and incomplete manufacturer information
- Incorrect equipment locations or classifications
- Duplicate asset entries or entirely missing assets

These inaccuracies created challenges for maintenance scheduling and asset management activities. To develop PM programs effectively, accurate asset quantities and information are required during tender development to define the correct scope of work and pricing arrangements. PM programs in IRC became a practical mechanism for correcting and

improving asset data integrity. During PM activities, information including make, model, serial number, operational status and physical location was collected, recorded and validated.

This process significantly improved confidence in the accuracy of the OAR and strengthened the organisation's ability to use asset data for operational and strategic purposes. The interaction between PM and asset registry management demonstrates that maintenance programs can provide significant organisational value.

2.5 PM and Asset Management

The relationship between PM and AM is highly interconnected and mutually beneficial. AM provides the strategic framework for managing assets throughout their lifecycle, while PM generates the operational data required to support informed asset management decisions.

AM requires accurate information regarding up-to-date asset condition, risk, criticality and maintenance history. PM activities provide much of this information through periodic inspections, servicing activities and condition assessments. Without reliable field data, AM strategies may rely excessively on theoretical assumptions or age-based forecasting.

PM contributes to AM in several critical areas:

- Asset Condition Assessment: Periodic inspections under long-term contracts with qualified service providers provide current condition assessment results using consistent methodologies and experience. This supports risk-based decision-making and renewal prioritisation.
- Maintenance Records Keeping and Maintenance Development: PM records identify potential risks or equipment condition changes. Service providers are requested to provide recommendations for proactive maintenance. This data helps identify potential equipment issues prior to actual breakdowns and supports investment of resources based on evidence.
- Lifecycle Planning: Condition-based information collected through PM supports more accurate estimation of asset RUL and renewal timing.

The integration of PM and AM promotes a shift in organisational culture from reactive maintenance toward proactive asset ownership. Maintenance activities become aligned with long-term service delivery objectives rather than short-term operational responses.

3.0 CONCLUSION

DRDMW (2021) states that AM is the coordinated activity of an organisation to determine how best to acquire, operate, maintain, renew, replace and decommission assets to deliver agreed standards of service. Achieving effective AM therefore requires accurate, reliable and current information generated through asset-related activities.

The PM program implemented within IRC has demonstrated significant organisational value beyond routine maintenance activities. Over the past three years, IRC PM has evolved into an important mechanism for collecting and validating operational asset information, improving data integrity and supporting evidence-based decision-making across organisational areas.

The interaction between PM and AM has proven particularly significant. PM provides current condition assessment data, operational observations and maintenance histories that support lifecycle planning, risk management and renewal prioritisation. In return, AM frameworks assist in prioritising maintenance activities based on asset criticality and service delivery requirements.

IRC's experience demonstrates that PM is not solely a maintenance activity, but a critical organisational process that contributes significantly to asset knowledge, strategic planning and long-term infrastructure sustainability.

4.0 ACKNOWLEDGEMENTS

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