

P3.48 Sustainable asset management

Selecting optimal maintenance strategies
based on multi-criteria decision making

Subtopic: building maintenance and performance evaluation

Project Leader: Professor Xiangyu Wang (Curtin)

Lead researcher: Dr. Peng Wu (Curtin)



Sustainable Built Environment National Research Centre



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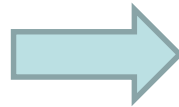
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- Industry problems
- Current practices
- Benchmarking
- Outcomes



Industry values

Background

Building maintenance

QDHPW has comprehensive facilities management frameworks, including building frameworks (i.e. building asset performance framework and strategic asset management framework) and building maintenance (including maintenance management frameworks).

Facilities management

- [-] Building frameworks
 - [+] Building Asset Performance Framework
 - [+] Strategic Asset Management Framework
- [-] Building maintenance
 - [+] Maintenance Management Framework
- [+] Facilities for government

Industry problems

Current assessment frameworks

1. Building frameworks

1.1 Building Asset Performance Framework

1.2 Strategic Asset Management Framework

1.2.1 Building management

1.2.2 Maintenance management

1.2.3 Asset review and analysis

1.2.4 Management of government building

1.2.5 Post occupancy evaluation

1.2.6 Risk management

1.2.7 Value management

1.2.8 Workplace health and safety

2. Building frameworks

2.1 Maintenance Management Framework

Problem

Do these frameworks represent the best building maintenance performance evaluation of government buildings?

Current practices

Building Asset Performance Framework: a best practice guideline for the performance assessment of Queensland Government buildings

Performance area (Refer 7.2.1)	Performance indicator (Refer 7.2.2)	Performance measure (Refer 7.2.3)
Appropriateness	Capacity	Department-specific measure or BAPF rating scale
	Functionality	Department-specific measure or BAPF rating scale
	Location	Department-specific measure or BAPF rating scale
	Condition	MMF Condition Index rating scale or Facility Condition Index
	Remaining life	Estimated years to end of useful or economic life
Financial	Operating cost	Quantitative department-specific measure
	Maintenance cost	Quantitative department-specific measure
	Deferred maintenance cost	Quantitative department-specific measure
Statutory compliance risk	Extent of non-compliance	Department-specific measure
Effective use	Utilisation rate	Level of utilisation as a % of available capacity or department-specific measure
Environmental impact	Impact of building asset on environment	Department-specific measure
Social significance	Significance in meeting government priorities or community obligations	Department-specific measure

Current practices

Maintenance Management Framework: Policy for the maintenance of Queensland Government buildings

Maintenance program management

- expenditure against budget
- achievement of planned maintenance program (time, cost and quality)
- unplanned and planned maintenance as percentages of total expenditure
- level of deferred maintenance.

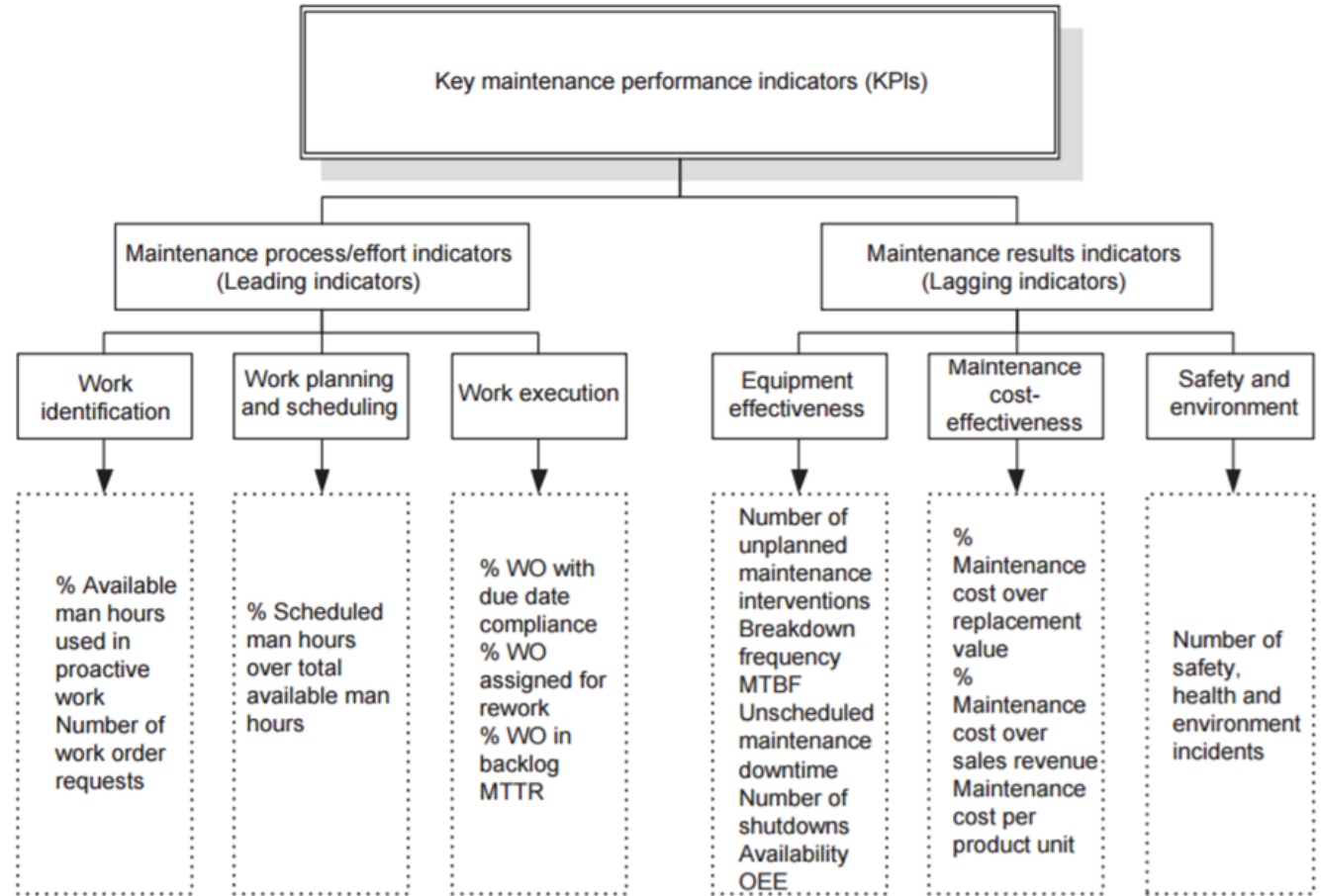
Maintenance service provider

- efficiency and effectiveness of:
 - people
 - processes
 - systems
 - management
- compliance with the MMF
- achievement of key performance indicators in the SLA.

Maintenance outcomes

- total maintenance expenditure as a percentage of building portfolio replacement value
- building occupant satisfaction with overall condition and reliability of building services
- Facility Condition Index.

Benchmarking



Hong Kong Building Maintenance Scheme

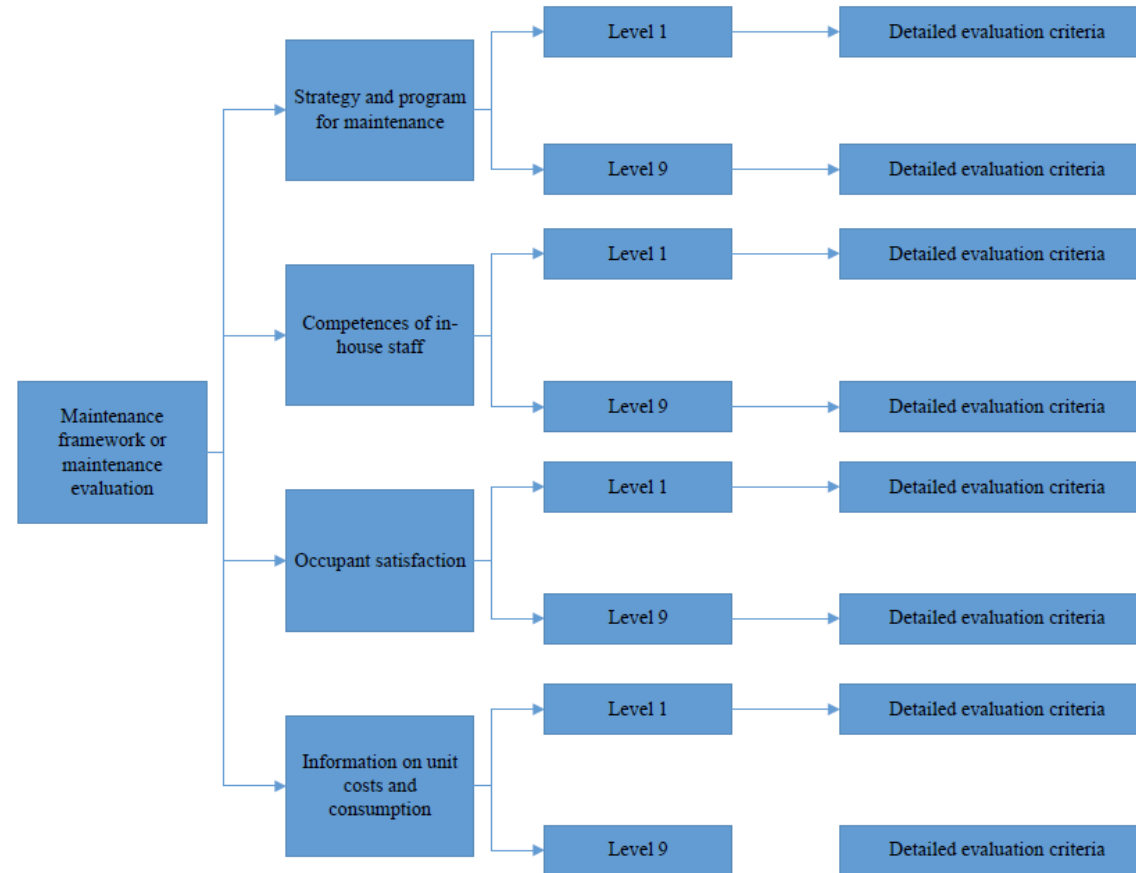
Benchmarking

The United States

The U.S. government uses the ***ATEM E1670-95a: Standard Classification for Serviceability of an Office Facility for Management of Operations and Maintenance*** to estimate the serviceability of an existing facility, which is the capability of an office facility to meet certain possible requirements for maintenance.

Benchmarking

The United States



Benchmarking

The United States

Strategy and program of maintenance	
Requirement Level – 9	
Level of maintenance	Require buildings to be maintained and operated at a high level, helping occupants to be fully productive within their work environment.
Tolerance for occupant loss of productivity	Any loss of productivity due to breakdown of building services cannot be tolerated.
Availability of support services	Need highly organised and responsive support service available to supplement in-house staff.

Strategy and program of maintenance	
Strategy and program	Clearly documented O&M strategy, e.g. cooling, ventilating and power.
Adequacy of budget	Budget is appropriate to carry out strategy.
Human resources	One maintenance person per 40,000 sq ft. More than 25% is spent on preventative maintenance.
Maintenance contractors	Outside resources are readily available and retained by firm contractual agreements.

Strategy and program of maintenance	
Requirement Level – 5	
Level of maintenance	Require buildings to be operated and maintained in a manner acceptable to the typical occupant in that locality.
Tolerance for occupant loss of productivity	Breakdown of building services can be tolerated if rarely occurring, having minor effect on productivity, causing only minimal disruption and requiring same-day repair.
Availability of support services	Require support services to be available.

Strategy and program of maintenance	
Strategy and program	Brief written O&M strategy, e.g. cooling, ventilating and power.
Adequacy of budget	Budget is tight and barely sufficient
Human resources	One maintenance person per 75,000 sq ft. Less than 10% is spent on preventative maintenance.
Maintenance contractors	In-house staff available for basic maintenance and contractors are available at peak workload times.

Benchmarking

QDHPW – Maintenance Management Framework

Functional purpose	Specified standard	Rating
Highly sensitive purpose with critical results (e.g. hospital operating theatre) or high profile public building (e.g. Parliament House).	Building to be in the best possible condition. Only minimal deterioration will be allowed.	S5
Good public presentation and a high quality working environment are necessary (e.g. modern multi-storey CBD building).	Building to be in good condition operationally and aesthetically, benchmarked against industry standards for that class of asset.	S4
Functionally-focused building (e.g. laboratory).	Building to be in reasonable condition, fully meeting operational requirements.	S3
Ancillary functions only with no critical operational role (e.g. storage) or building has a limited life.	Building to meet minimum operational requirements only.	S2
Building is no longer operational—it is dormant, pending disposal, demolition, etc.	Building can be allowed to deteriorate, however, must be marginally maintained to meet minimum statutory requirements.	S1

Benchmarking

The UK

Building maintenance management in UK is regulated by different councils. The maintenance evaluation relies on the owner's consideration. However, it is centrally guided by **the British Standard (British Standard Institution, 1986, 1992, 2012): Guide to facilities maintenance management.**

- 1. Compliance.** Services will be delivered in accordance with relevant statutory legislation and appropriate guidelines including British Standards, Manufacturers Recommended Instructions, etc.
- 2. Value for money.** Random sample checks will be made on 20% of all maintenance works carried out by contactors.
- 3. Quality of service.** The client will monitor contractors/consultants' performance annually or as required against quality indicators including timeliness of response, health & safety, safeguarding and quality of works on site.
- 4. Customer satisfaction.** The client will appoint a dedicated liaison officer for each building who will undertake regular liaison with the building consistent with the scale and complexity of works being undertaken.

Outcomes

1. The overall frameworks

1. Building frameworks

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2. Building frameworks

2.1 Maintenance Management Framework

Maintenance program management

- expenditure against budget
- achievement of planned maintenance program (time, cost and quality)
- unplanned and planned maintenance as percentages of total expenditure
- level of deferred maintenance.

Maintenance service provider

- efficiency and effectiveness of:
 - people
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Maintenance outcomes

- total maintenance expenditure as a percentage of building portfolio replacement value
- building occupant satisfaction with overall condition and reliability of building services
- Facility Condition Index.

Outcomes

2. The maintenance performance evaluation

The review indicates that maintenance management is in a transition from prescriptive based specification towards a performance-based evaluation. The Hong Kong and the U.S. has developed detailed set of metrics to evaluate building maintenance work.

Maintenance program management

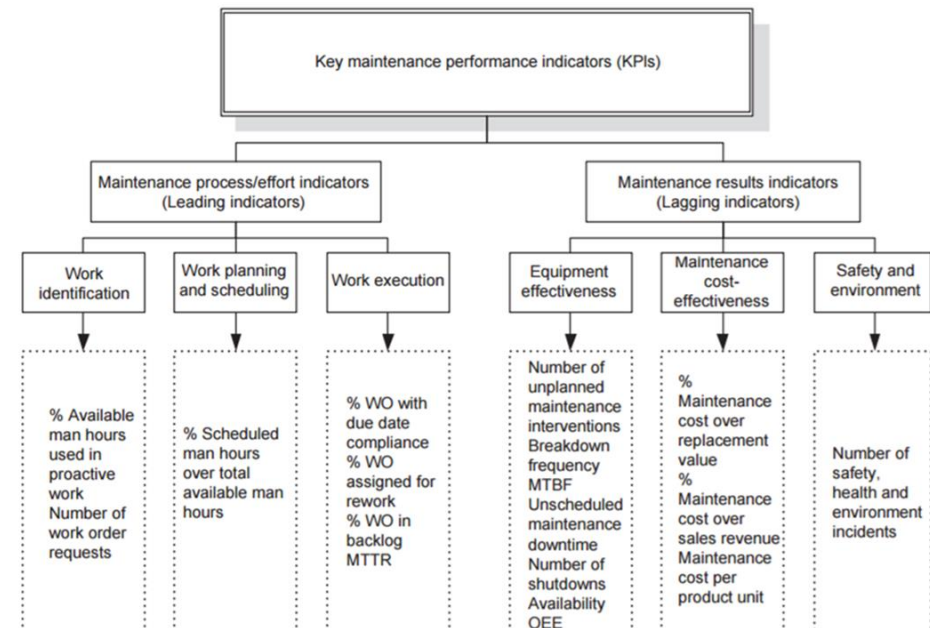
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Outcomes

3. The classification

It is also beneficial to separate the evaluation criteria for different levels of building maintenance. For example, the American Standards classify 9 levels of building maintenance performance levels. The owners may select the correct levels in order to identify the appropriate evaluation criteria. This is useful to maintain a high level of maintenance efficiency.

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Outcomes

4. The information storage and usage

This review also finds that improving the operations of building maintenance requires many supportive facilities for both management and technology aspects. How to successfully capture these information in information technology is a research trend at the time of this study. This will help maintenance teams learn from previous experience and trace the full history of a building element and all affected elements by previous maintenance operations.