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The Great Asset Race.

Asset Management E-book | April 2025

From a young age, society conditions us that owning ‘assets’ – including financial assets, physical assets, such as property, and virtual assets, such as cryptocurrency – is a measure of success.

In industry, when we consider assets, the type of assets we consider important changes depending on:

- Nature of business
- Operational context
- Financial constraints
- Regulatory requirements
- Needs / expectations of stakeholders or shareholders[1]

These factors need to be considered when establishing an asset management program for a business, company or site, where the fundamentals of asset management were established by the ISO TC 251 in June 2010 under ISO 55000[2].

But what is asset management?

What is Asset Management?

Asset Management is a **systematic approach to governance and realisation of value for all assets in which a business or company is responsible for**[2]. This may be applied to physical, financial or virtual assets.

The end-to-end asset management process includes developing, operating, maintaining, upgrading and disposing assets in the most cost-effective and sustainable manner considering cost, risk and asset performance.

WHAT ARE WE COVERING IN THIS E-BOOK?

We will be dive into the detail of **physical asset management**.

To most people in industry, **physical asset management refers to the maintenance of an equipment or asset item that has been installed on site**. However, a good end-to-end asset management strategy considers the full life cycle of an asset.

Referring to Figure 1, we can compare an asset's life cycle to a bathtub, where the x-axis is time, and the y-axis is failure rate of an asset.

Asset Management Lifecycle Curve

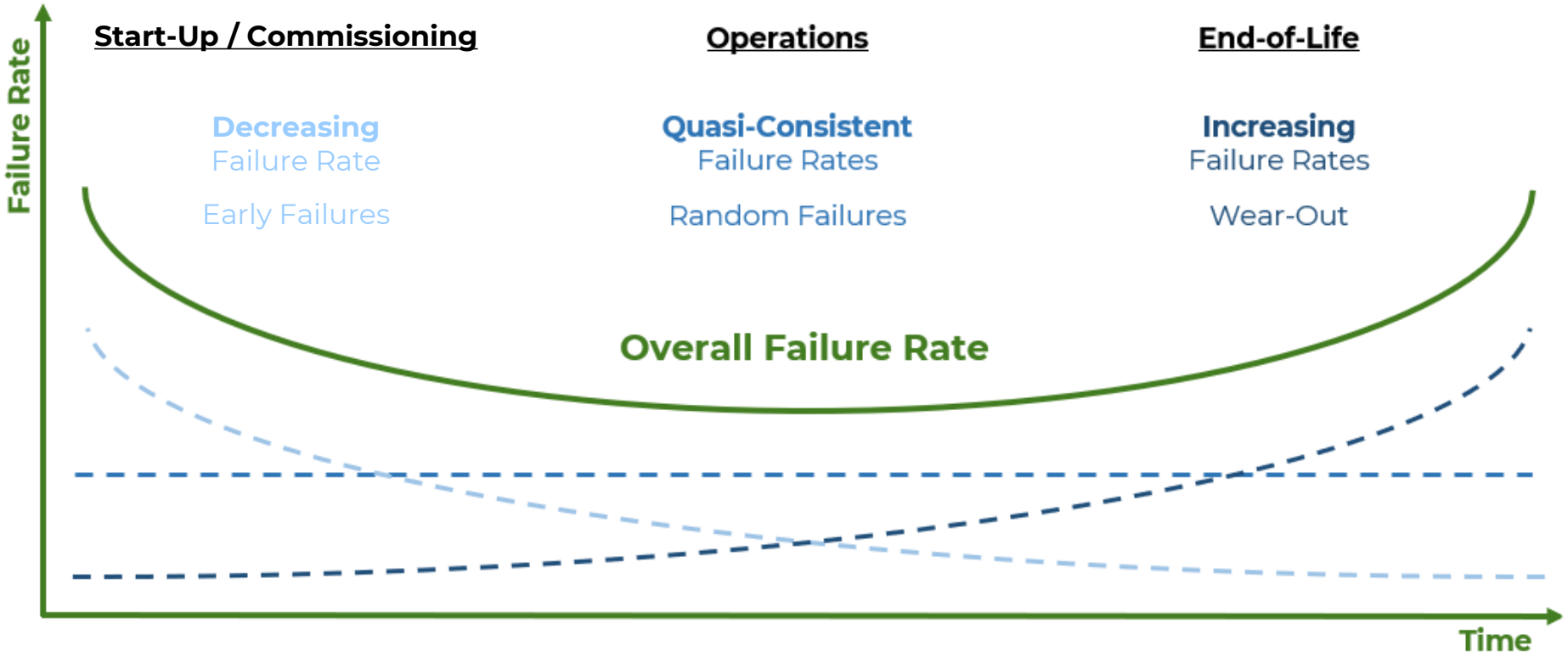

Figure 1: Asset Management Life Cycle Curve

When we first install and commission as asset – for example, an air compressor – **there are always "teething issues" or defects which we consider as early failures**. In this period, we see higher numbers of issues as equipment is cut into a larger system or building – e.g. pressure issues, electrical shorts, filter failures due to excess swarf in lines etc. **But as these issues are resolved, there is a marked decrease in failures seen.**

Over the main portion of the asset life cycle, and with the appropriate level of maintenance, we see a **reasonably consistent number of ad-hoc issues with the asset**. During operations, these are considered random failures and may come from numerous sources – e.g. site power failure, consumable fault, poor maintenance, incorrect parameters used etc.

As the asset ages towards end of life, we see an increasing number of failures with the asset, for example material failure, seals, electrical components failing etc. The risk is, as equipment ages, spares and replacement may become limited due to newer models being available.

An additional issue seen is defining an asset 'end-of-life' date or period. Often, we rely on the manufacturer's recommendations, however in some cases, this is reached prematurely with incorrect maintenance, but conversely, may be extended beyond recommendations with the correct balance of predictive and preventative maintenance.

Once an asset reached its end-of-life, an appropriate replacement strategy must be in place to ensure operational continuity.

If we take a closer look at the asset life cycle curve, **we see that there are three key sections to an asset's lifetime** – Start-Up / Commissioning, Operations and End-of-Life.

Within each section, **further sub-sections can be considered**, including (but not limited to):

- **Start-Up / Commissioning**
  - Asset Definition and Risk Categorisation
  - Asset Selection
  - Asset Installation and Commissioning
  - Asset Data Collection
  - Asset Maintenance and Spares Strategy
  - Asset Visualisation / Verification
  - Asset Data Upload
- **Operations**
  - Asset Maintenance Execution / Testing / Shut-Down
  - Asset Demand Planning and Monitoring
  - Asset Validation (if appliable)
  - Asset Reliability
- **End-of-Life**
  - Asset Replacement / Disposal
  - Asset Reconditioning

Why is this important?

Understanding what phases / sections make-up an asset's life cycle is **important when establishing a risk-based approach to asset management**. Each section and sub-section has different risk considerations.

If we consider the Start-Up / Commissioning phase, we assume that the asset has not had a risk classification assigned. Therefore, the asset should always undergo an assessment to define the criticality based on operational, business and safety requirements.

If a single asset is critical for all operations – e.g. WFI system in an API facility – and the system has no redundancy, this increases the criticality of the asset. Therefore, impacting maintenance criticality, spare part strategy and end-of-life strategy.

In another example we could consider a cooling tower. Generally, cooling towers are used to support multiple operations, however are designed with significant redundancy, therefore reducing criticality. Spares and replacement components are also generally in abundant supply, therefore lowering risk. However, if we consider cooling tower cleaning, from a safety perspective, this could be considered at a high risk.

Taking a **risk-based approach** and tailoring it to the specific life cycle stage of the asset will ensure that data driven decisions are made which align with the business asset management strategy.

Uninformed decision-making may lead to financial, operational and safety impacts which could cripple a small / medium business or start-up venture.

But what is Industry Standard?

A quick interest search for ‘asset management’ provider numerous examples of white papers and articles, but above all, **there are three international standards, ISO 55000, 55001 and 55002**, which provide a global consensus on asset management. The standards provide terminology, requirements and guidance for implementing, maintaining and improving an effective asset management system.

ISO 55000 provides an overview of the principles and terminology, ISO 55001 specifies the requirements for an asset management system including establishment, implementation, maintenance and improvement, and ISO 55002 provides guidance for the application of asset management system and supports ISO 55001.

These standards support businesses to:

- Establish asset management system/s to optimally manage assets
- Implement, maintain and improve an asset management system
- Comply for asset management policies
- Demonstrate best practice
- Support external certification (if required)[3]

Fundamentally, **there are different levels of asset maintenance that are applied in industry, from ‘Regressive’ or ‘run to failure’ models** and increase in both running cost and reliability as per Figure 2.

If we consider the upper end of the scale, EAM Systems, this represents various asset management models that can be used in industry, each of which can be achieved in a number of ways.

Some examples of Asset Management models include:

- Institute of Asset Management (IAM)
- Bottom-Up / Top-Down
- Integrated Dependencies EAM System

Ultimately, each of these models are centre around a typical asset lifecycle model shown in Figure 3.

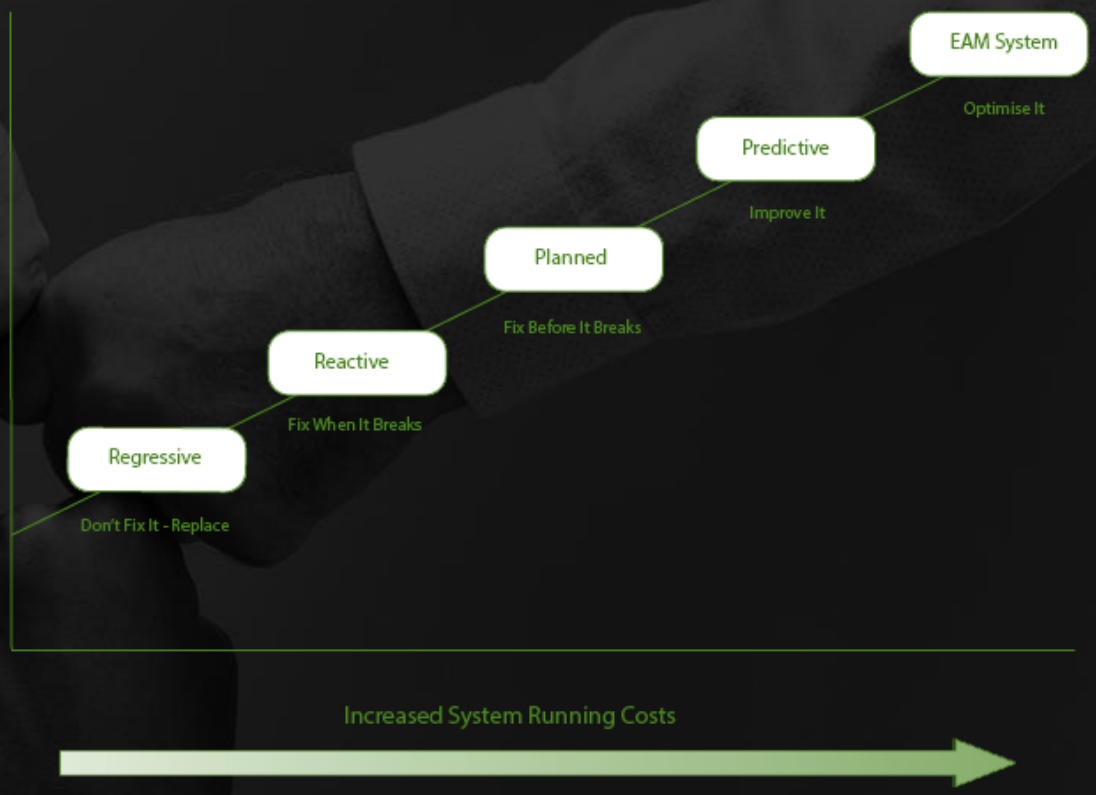

Figure 2: Maintenance Levels based on reliability and cost[4]

The Asset Lifecycle can be considered in five key parts:

- **Plan:** This is the start of the asset life cycle, where the engineering team are responsible for planning which assets require replacement over a period of time – e.g. 5-year plan. In some cases, assets may require significant financial input, which will require the associated level of planning and approvals.
- **Acquire:** Once the asset as be scoped and appropriate asset selected, this phase covers the procurement the asset, including installation and commissioning as required. This step will also include setting up the associated data in your asset management system.
- **Operate:** This phase covers the regular operation of the asset on the shop floor. During this phase, the engineering team may collect data to ensure the appropriate maintenance plan/s are in place and critical spares are maintained on site or with the vendor.
- **Maintain:** This phase covers the maintenance of the unit. This will include planned and reactive maintenance. In some cases, this may include predictive maintenance or shut-down activities. For regulated environments or assets, there may be additional maintenance, cleaning, validation and / or audit requirements. It is critical to ensure that all legislative requirements are covered in this phase.
- **Dispose & Replace:** Once the asset has reached its end-of-life, it may be reconditioned, replaced and/or disposed. It's recommended that an assessment is completed to ensure appropriate documentation of the asset end-of-life decommissioning / replacement is captured. This is specifically important for regulated environments.

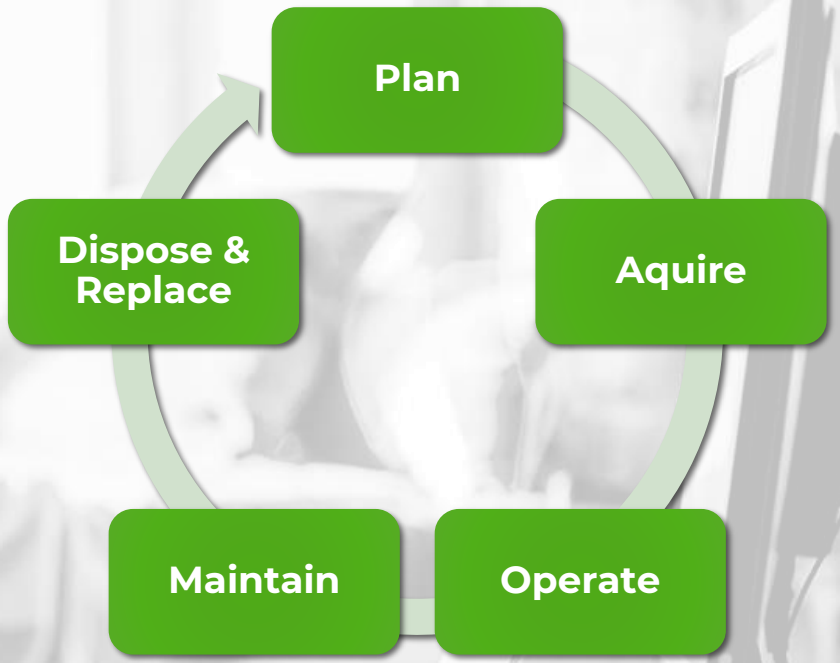

Figure 3: Asset Lifecycle Overview[5]

Depending on the business, site and / or operational model, the **resources required to support asset management activities changes**. For example, in Start-Up / Commissioning, these activities may be covered by project engineering resources or outsourced service provider.

But regardless of stage, for any site, **there should be a team responsible and accountable for asset management**. And, in many cases, there is a single point of contact, such as an Asset / Maintenance Manager or Engineering Director, who is overall accountable for all assets on site, and subsequently their team is responsible for executing and maintaining the asset management program.

Who are the dream team?

An example of an Engineering team organisational chart is shown in Figure 4, noting that the example shown is specifically for pharmaceutical/ regulated application, but can be adapted to many other industries.

At a high level, the roles and responsibilities of each team member are summarised in Table 1 (found in the Appendix).

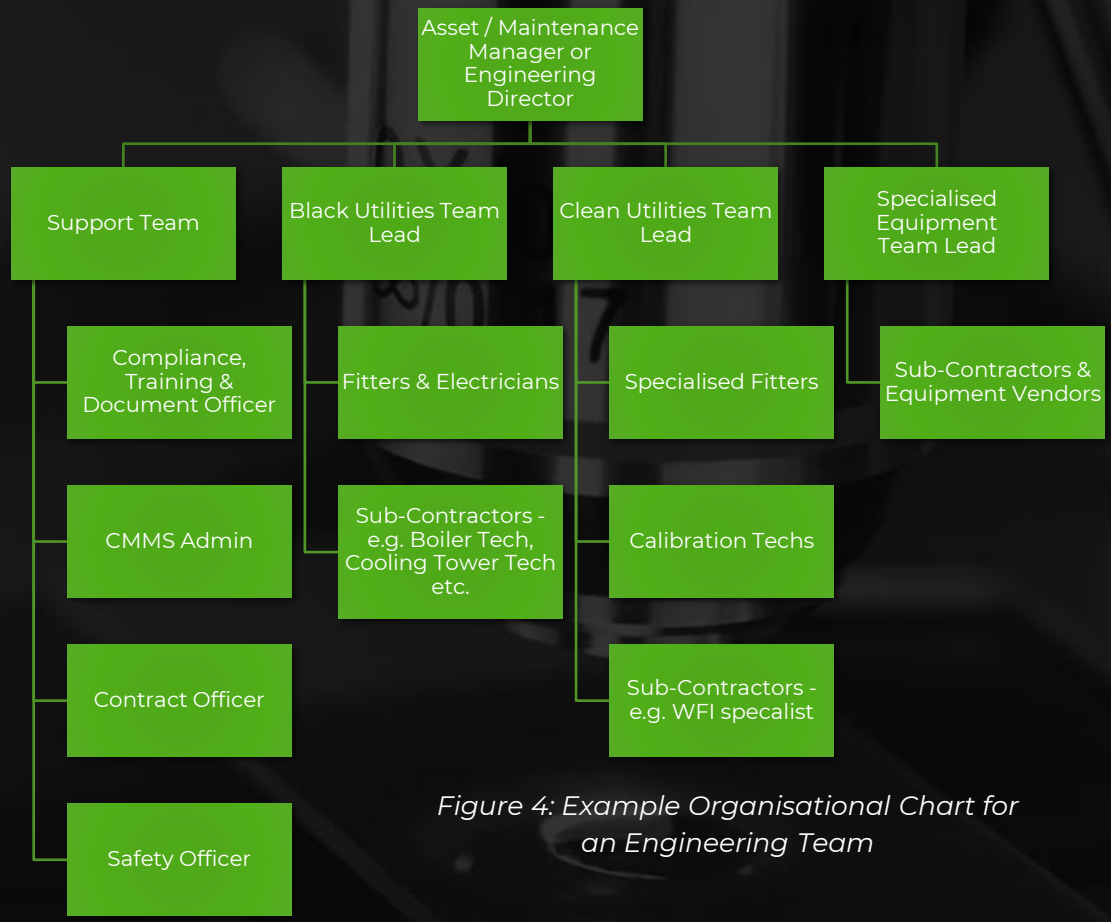

Figure 4: Example Organisational Chart for an Engineering Team

Some additional roles that may need to be considered based site requirements includes:

- **Facility Manager** to manage outsource contracts (e.g. IFM) and/or general site requirements (e.g. landscaping, landlord engagement, budget management, cleaning, waste etc.). This role may also act as the Support Team Lead and reports to the Asset / Maintenance Manager.
- **Capital Project Manager** to manage any new equipment projects, including procurement, installation and CQV activities. This role could also support overall management of asset life cycle programs and asset depreciation information. This role may report to the Facility Manager.
- **Engineering Warehouse Admin** to manage spare parts for site, including procurement, stocktake, data management, preparation of spare part kits, ordering long lead items etc. This role may also be responsible for asset disposal and returns to vendors / sub-contractors. This role may report to the Facility Manager or could report into Supply Chain.
- **HVAC Technician or Engineer** to manage HVAC maintenance and support systems. This role would report to the Black Utilities Team Lead.
- **Electrical Engineer** to manage central electrical systems, generator and UPS systems. This role would report to the Black Utilities Team Lead.

These roles will depend on how your facility support model is structured. For smaller companies, these responsibilities can be assigned to others within the organisation meaning dedicated roles may not be required.

BUT WHAT'S THE RISK?

It's **common within big businesses to have misalignment between functional areas when considering the importance of asset management** and the quality of data uploaded or included in the system.

What normally resonates with all areas of a business is considering the risks of poor asset management, including data management.

In Australia, Deloitte considers asset management risk as an ‘Asset Management Loss Pyramid’[6]

This concept considers some key pain points which translate to operational risks on the shop floor. **These can be grouped into people, process and technology issues.** For example:

- **People Problems:** Team misalignment or lack of training, excess equipment downtime – both scheduled and unscheduled – due to poor practises
- **Process Problems:** Critical safety and asset integrity failures due to insufficient maintenance oversight or plans, excessive spend on reactive maintenance leading to maintenance debt or cost uncertainty, excess productivity losses due to poor practises and management, poor financial budget management against actual spend
- **Technology Problems:** Poor data management due to system complexities, not achieving full asset life due to poor data or system management

Figure 5: Deloitte Asset Management Loss Pyramid[6]

Ultimately...

Poor Asset Management = Poor Operational Performance

Poor asset management can lead to:

- Increased Production downtime
- Reduced throughput of product
- Reduced company revenue
- Increase operational costs
- Reduced trust within teams / businesses / clients

The good news is that these **risks can be mitigated with good asset management and maintenance practises are implemented.**

For existing sites, it’s never too late to start cleaning your asset data and for new sites or businesses, it’s never too late to implement an appropriate strategy!

Benefits of Asset Management

We've considered the risks, but what are the benefits associated with tracking, managing and optimising an asset management system? Benefits can be split into five key areas:

- **Financial:**
  - Cost optimisation leading to cost reduction over time
  - Improved Return on Investment (ROI)
  - Accurate budgets and forecasting
- **Operational:**
  - Streamlined operations and resource optimisation
  - Increased productivity due to well performing equipment
  - Reduced downtime due to proactive maintenance schedules
  - Improved business continuity and disaster recovery planning
- **Decision Making:**
  - Data driven decisions regarding asset performance, capital / budget planning and product transfer between products between facilities / product lines
  - Improved planning of future equipment upgrades or replacements
- **Risk Management:**
  - Reduced operational risk by improved scheduling of planned and predictive maintenance
  - Enhanced compliance and adherence to legislation and other licences
  - Improved security due to asset being properly tracked and managed
- **Sustainability:**
  - Potential to extend asset lifespan, reducing waste or replacements
  - Improve equipment utilisation and potential to reduce energy consumption through optimisation and data collection

Other benefits of asset management also include **improved reputation / customer reliability, improved internal stakeholder management and trust within the business**.

What does this look like in the real world?

Consider a new site, you've received the keys from the builder. Your equipment is commissioned, the lights are one and you're ready to push product out the door – what's next?

Often in these large projects, **we see that the system is technically ready, or system ready, but there is no data available.** At this point, the system is ready, but not business ready. So, what do we do? **This is where operational readiness becomes important**. Referring to Figure 6, we can consider three key pillars – people, process and technology (or system) – and the overarching documents required to implement a system ready for day one.

The **'House of Asset Management' approach** can apply to **a new site, existing site or even a site who is transitioning** from one asset management to another as it considers high level readiness for day one.

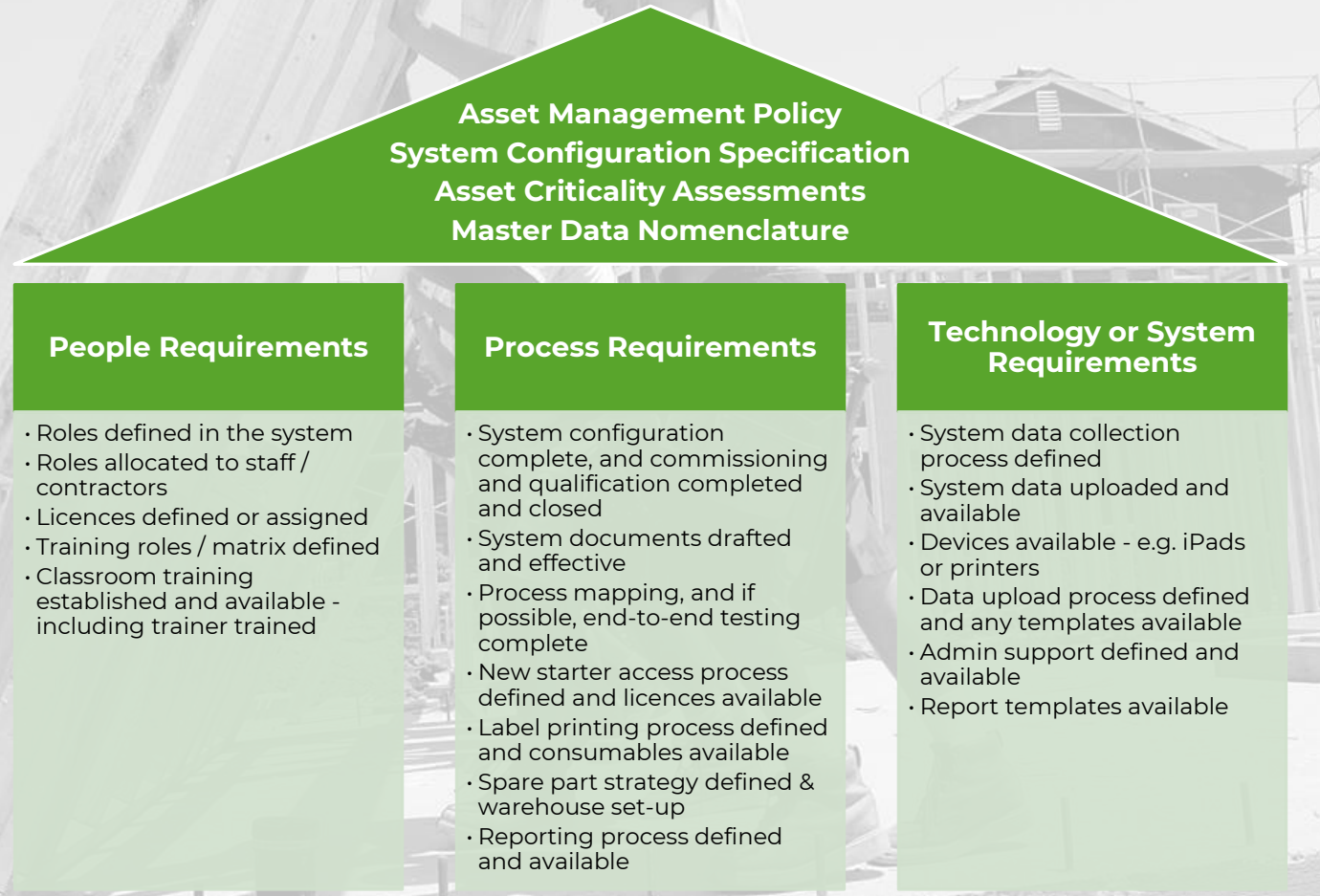

Figure 6: House of Asset Management People, Process and Technology

As represented in Figure 6, there **are four key documents** that should be considered before collecting data and establishing an asset management system. These include:

- **Asset Management Policy** which defines the strategy for implementation, maintenance and optimisation of the system, process and application. This should also include references to support and roles and responsibilities for staff within the business.
- **System Configuration Specification** which defines the physical system being implemented including critical data requirements and specific functions being utilised by the business or site. This may also include security roles and any segregation of duties applied in the system.
- **Asset Criticality Assessments** which take a risk-based approach to asset management. These support the asset management policy or strategy by defining the boundaries on how to manage your assets – for example, all critical assets need to be uploaded, but low criticality assets do not require upload and are considered ‘run to failure’.
- **Master Data Nomenclature** which defines a standardised naming conventions for your data to ensure that clean data is uploaded initially into the system and maintained for the on-going application of the system.

Once these documents are defined, we can move into establishing a set of minimum requirements for system readiness, similar to the one shown in Figure 6.

Each of these requirements should be set up as a statement and generally consists of several pre-requisites tasks that need to be completed to meet the minimum requirement.

For example, **one of the Technology requirements states, "System data uploaded and available"**

Some of the pre-requisite tasks that are required before this requirement is met may include:

- Compile a consolidated equipment list for site / facility
- Complete criticality assessments for each asset or group of assets
- Define minimum required data to be collected in upload template – this could include asset data, maintenance plans and/or spares
- Collect asset data via visual inspections and review of asset document to populate templates
- Define baseline maintenance plans for each asset based on OEM and business requirements – e.g. some assets may require on-going validation based on licence requirements
- Define spares and/or consumables for each asset based on OEM and business requirements – this may include completing a spare criticality assessment (depending on business requirements)
- Populate relevant templates to upload maintenance plans and spares (these may be separate to asset upload templates)
- Upload data into system – which may include a test system before going live in the production environment
- Test data to ensure upload completed successfully
- Close any change controls, deviations and/or CAPAs

Note, depending on business requirements you may also need to complete the following sub-tasks:

- Qualify vendors / sub-contractors to perform critical maintenance activities, including ensuring they are on an approved vendor list
- Prepare quality agreements and/or audit vendors / sub-contractors
- On-board relevant vendors / sub-contractors into HR, safety, procurement and quality systems
- Upload spares / consumables and other materials into material management systems which may be separate from the business asset management system

Although the minimum requirements may seem ‘simple’, there is a deeper complexity when you look at each requirement individually and define the pre-requisite tasks.

And in some cases, some of these asset management requirements may be the responsibility of an outsourced service provider or facility management service. Which can present additional complexity around timelines, cost and data / system ownership. All of which adds to the complexity of site or business asset management.

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Our Recommendation.

The best advice we can give...

Rubbish in = Rubbish out.

It's great to have a world-class or holistic strategy, but if on-going execution or utilisation of the system is not maintained or the data is not accurate / timely, this can lead to a messy system and re-introduce risk to operations.

So, to ensure your asset management strategy is an **on-going success**, I would recommend the following:

- Follow asset management best practise and stick to them
- Develop a strong strategy that is achievable at the execution level
- Ensure you have appropriate support and/or resource model in place – keeping in mind that a large and complex strategy (or multi-system strategy) generally needs a lot of people!
- Start with good quality data, and if not – fix your data or course correct your processes
- Track all your assets to ensure your data is up to date
- Develop maintenance KPIs that measure efficiency and report on these regularly

And lastly, **hire an expert**. Having someone guide and shape the not only the strategy, but mobilisation and on-going success is important to fully realise the benefits of your system.

Let's Collaborate!

To us, this means each service provided to a client is tailor built depending on the client's brief and current roadblocks (or 'big rocks').

EngCor are **action-orientated, result-driven engineers** who are technical specialists in p**rocess design and life science operations**. We focus on projects, so that clients can focus on operations. **With 10+ years' experience in capital project delivery and R&D operations**, our services range from GMP / lab projects and operational readiness, utility process design, outsource service preparation and mobilisation, project control and **end-to-end project management services**.

Examples of Services we provide the following services to food, beverage and life science industries:

- Project Management, including capital and operations
- Process Design for utilities and equipment
- Operational Planning and Strategy
- Operational Change Management Strategy Development and Implementation
- Document and Training Preparation
- Alarm Management and Rationalisation
- Outsource Mobilisation including Scope and Contract Preparation
- **Asset Management Strategy and Data Preparation**
- **CMMS Mobilisation**

We have a passion for streamline processes and driving efficient operations. Reach out to us at admin@engcor.com.au to schedule a **free call** or visit our website at engcor.com.au

Thanks for reading!

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Appendix

Table 1: Summary of the Asset / Maintenance Team roles and responsibilities

Workstream	Role	Responsibilities
Leadership	Asset / Maintenance Manager or Engineering Director	• Develop and lead Operations Strategy for team • Set objectives and budget for team • Accountable for team deliverables • Accountable for site asset management and CMMS process owner • Ensure training and documentation for all team members is upto date and accurate • Lead compliance and safety audits
Support Team	Compliance, Training & Documentation Officer	• Documentation (e.g. SOP, WI etc.) updates and periodic reviews • Training updates and periodic reviews • Training Matrix ownership • Assigning training to new team members • Delivery of any classroom training • Deviation, Change Control and CAPA owner and support • Support compliance audits • Support supplier qualification and vendor change notifications / updates • Support spare part assessments, including E&L assessments
	CMMS Admin	• Generation and Updating CMMS data – inc. uploading of new assets • Preparation of work orders • Uploading reports from vendors • Closing work orders • Generating reports • Supporting CMMS training of new team members • Peripheral / device owner and technical support – e.g. iPads & label printers

Workstream	Role	Responsibilities
Support Team		
	Contract Officer	• Support procurement process for sourcing new vendors / sub-contractors • On-boarding of new vendors or sub-contractors • Support contract variations • Develop and report on vendor / sub-contractor KPIs • Manage breaches of contracts • Offboarding of vendors / sub-contractors as required • Manage budget for team • Raise POs for vendors and sub-contractors – including rolling / annual POs • Raise POs for spares, replacements and components • Manage invoices as required
	Safety Officer	• Safety on-boarding of vendors / sub-contractors • Owner of team safety management plan • Site walk-throughs and safety audits • Permit owner and support • LOTO owner and support • Lead any safety related training sessions • Owner of safety compliance licences and documentation – e.g. pressure vessels, confined spaces, vertical transport, cooling towers, pressure relief valves etc. • Trade Waste testing support • Owner of safety equipment for maintenance – e.g. anchor points, gas safety equipment etc.

Workstream	Role	Responsibilities
Black Utilities / Building Services	Black Utilities Team Lead	• System owner for black utilities / building services – e.g. fire systems, lighting, boilers, cooling towers etc. • Ensure black utilities / building services are operating efficiently • Manage maintenance for black utilities / building services • Review and approve maintenance work orders relating to black utilities / building services • Ensure reports from sub-contractors are accurate and issue to CMMS admin for upload • Support safety inspections, compliance audits etc. • Review equipment / maintenance logbooks • Support operations and investigations for black utilities / building services issues • Alarm owner for black utilities / building services • Support vendor / sub-contractor escorting to execute maintenance • Support procurement of spares and replacements – e.g. cooling tower chemicals • Lead any improvement projects related to black utilities / building services
	Fitters & Electricians	• Execute on maintenance for black utilities / building services – e.g. fire systems, lighting, generators, boilers, cooling towers etc. • Lead and repair black utilities / building services issues • Complete spares / parts stock-takes as required • Respond to alarms for black utilities / building services • Support vendor / sub-contractor escorting to execute maintenance
	Sub-Contractors	• Execute on maintenance for black utilities / building services – e.g. fire systems, lighting, boilers, cooling towers etc. • Provide reports to Black Utilities Team Lead for review • Provide SMWS prior to executing work • Ensure insurances are up-to-date

Workstream	Role	Responsibilities
Clean Utilities	Clean Utilities Team Lead	• System owner for black utilities / building services – e.g. fire systems, lighting, boilers, cooling towers etc. • Ensure black utilities / building services are operating efficiently • Manage maintenance for black utilities / building services • Review and approve maintenance work orders relating to black utilities / building services • Ensure reports from sub-contractors are accurate and issue to CMMS admin for upload • Support safety inspections, compliance audits etc. • Review equipment / maintenance logbooks • Support operations and investigations for black utilities / building services issues • Alarm owner for black utilities / building services • Support vendor / sub-contractor escorting to execute maintenance • Support procurement of spares and replacements – e.g. gas cylinders • Lead any improvement projects related to clean utilities
	Specialised Fitters	• Execute on maintenance for clean utilities – e.g. pure steam, WFI, sanitary gases etc. • Lead and repair clean utilities issues • Complete spares / parts stock-takes as required • Respond to alarms for clean utilities • Support vendor / sub-contractor escorting to execute maintenance
	Calibration Technicians	• Execute on calibrations for clean utilities – e.g. pure steam, WFI, sanitary gases etc. • Support calibrations for black utilities / building services as required • Complete spares / parts stock-takes as required • Respond to alarms for clean utilities • Support vendor / sub-contractor escorting to execute maintenance
	Sub-Contractors	• Execute on maintenance for clean utilities skids and equipment – e.g. WFI skid, purified water skid, gas manifolds etc. • Provide reports to Clean Utilities Team Lead for review • Provide SMWS prior to executing work • Ensure insurances are up-to-date

Workstream	Role	Responsibilities
Specialised Equipment	Specialised Equipment Team Lead	• System owner for specialised / process equipment – e.g. benchtop equipment, lab equipment, QC analytical equipment etc. • Ensure specialised / process equipment are operating efficiently • Manage maintenance for specialised / process equipment • Review and approve maintenance work orders relating to black utilities / building services • Ensure reports from sub-contractors are accurate and issue to CMMS admin for upload • Support safety inspections, compliance audits etc. • Review equipment / maintenance logbooks • Support operations and investigations for black utilities / building services issues • Alarm owner for black utilities / building services • Support vendor / sub-contractor escorting to execute maintenance • Depending on the equipment, support procurement of spares and components. This responsibility may sit with the equipment owner (e.g. lab equipment) • Lead any improvement projects related to specialised / process equipment
	Sub-Contractors & Equipment Vendors	• Execute on maintenance for clean utilities skids and equipment – e.g. WFI skid, purified water skid, gas manifolds etc. • Provide specialised components / spares for replacement as required • Provide reports to Specialised Equipment Team Lead for review • Provide SMWS prior to executing work • Ensure insurances are up-to-date

Table 2: Definitions & Acronyms

Acronym	Definition
CQV	Commissioning, Qualification and Validation
EAM	Enterprise Asset Management
e.g.	For example
etc.	Et cetera or ‘and other similar things’
HVAC	Heating, Ventilation and Air Conditioning
IAM	Institute of Asset Management
ISO	International Organization for Standardization
ISO TC	International Organization for Standardization Technical Committee
KPI	Key Performance Indictors
ROI	Return on Investment
UPS	Uninterrupted Power Supply

Table 3: References

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