PUBLICLY AVAILABLE SPECIFICATION

The Institute of Asset Management

PAS 55-2:2008

Asset Management

Part 2: Guidelines for the application of PAS 55-1

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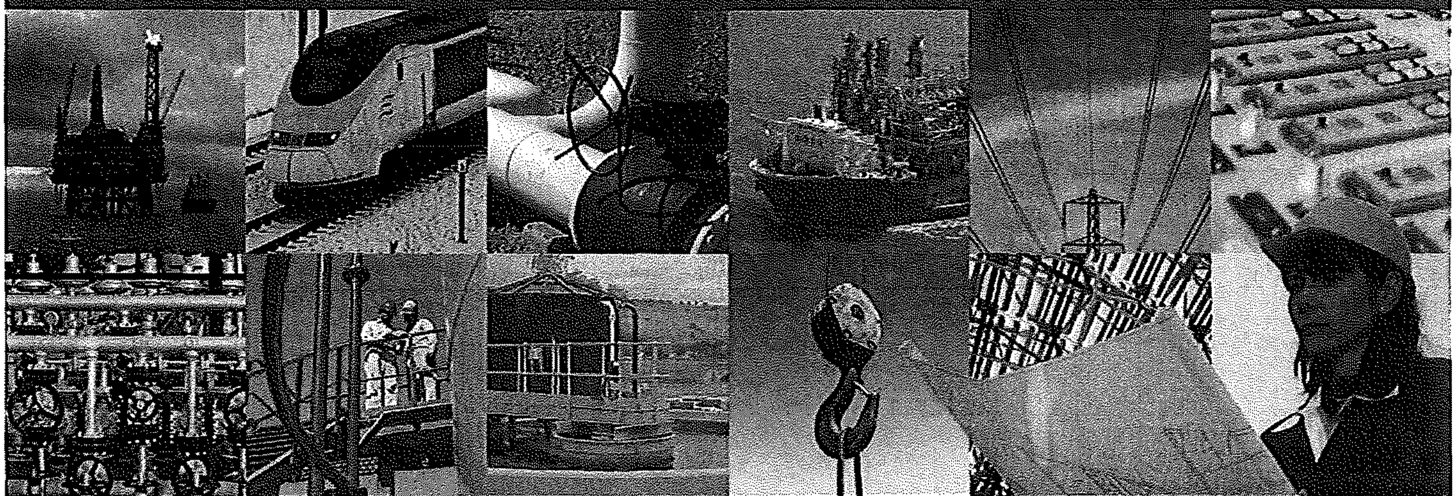

British Standards

ICS code: 03.100.01

Acknowledgement

The development of this Publicly Available Specification (PAS) has been led by the Institute of Asset Management (IAM), in collaboration with the British Standards Institution (BSI), with the assistance of the following co-operating organizations and individuals:

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- AMCL
- AMT-Sybex
- Atkins
- Atlantic LNG Co of Trinidad & Tobago
- BAE Systems (Operations) Ltd
- BC Transmission Corporation
- CE Electric UK
- CLP Power
- Continuon
- EDF Energy Networks
- E.ON Central Networks
- E.ON UK
- Essent Netwerk
- Fingrid Oyj
- Gas Transport Services B.V.
- Geometria
- GVB
- Gutteridge Haskins & Davey (GHD)
- Halcrow
- Hydro One Networks Inc
- KEMA
- Lloyd's Register
- Logica
- London Underground
- MTR Corporation Limited
- National Grid
- NATS
- Network Rail
- PB Power
- Office of the PPP Arbiter
- Scottish Water
- ScottishPower Energy Networks
- Tennet
- The Woodhouse Partnership
- Tube Lines
- UMS Group

Associates

- Canadian Gas Association
- CIRIA
- ENA (Australia)
- Health & Safety Executive
- International Water Association
- Nottingham University
- University of Manchester
- Ofgem
- Office of the Rail Regulator
- Royal Institution of Chartered Surveyors
- RWS
- Southern African Maintenance Association (SAMA)
- University of Leeds

Photographs

The contribution of photographs from the following organizations is gratefully acknowledged:

- EDF Energy
- Eurotunnel
- Lloyd's Register
- National Grid
- Scottish Water
- The Woodhouse Partnership
- United Utilities

Publishing and copyright information

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The following BSI references relate to the work on this standard:

Publication history

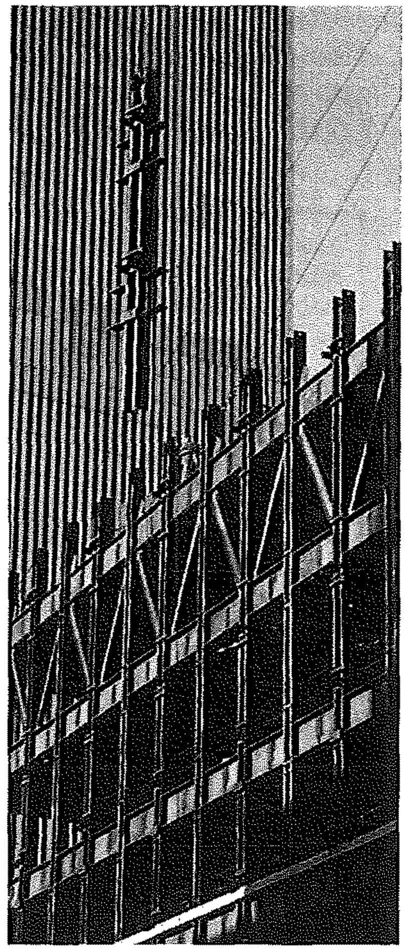
First published as Part 1 and Part 2, April 2004
First (present) edition as Part 1 and Part 2, September 2008

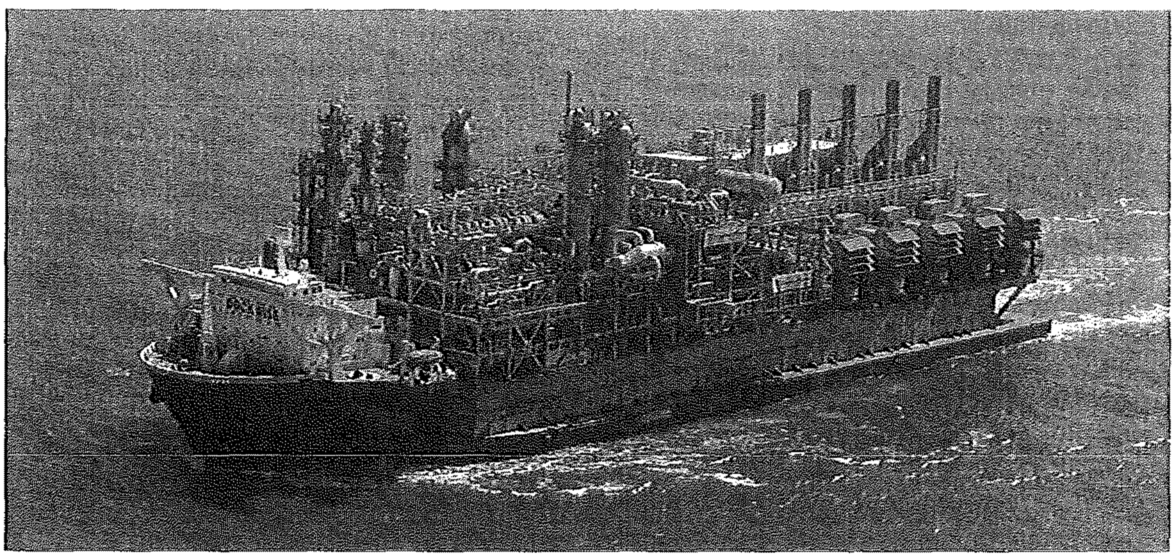
This Publicly Available Specification comes into effect on 15 September 2008.

Amd. No.	Date	Comments

ISBN: 978 0 580 50976 6

Contents





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Foreword

This part of PAS 55 (PAS 55-2) contains guidelines for the application of PAS 55-1. Please note that the terms and definitions are contained in PAS 55-1, and are not repeated in this part. The presentation style is similar to that adopted in BS EN ISO 9004 and OHSAS 18002.

The requirements specified in PAS 55-1 are reproduced in the outlined boxes and the associated guidance appears beneath these boxes.

Consultation

This PAS has been developed in consultation with a large number of organizations and individuals that are active and proficient in the field of asset management (see Acknowledgements).

Publishing information

This PAS comes into effect on 15 September 2008.

This PAS has been prepared and published by BSI, which retains its ownership and copyright. BSI reserves the right to withdraw or amend this PAS on receipt of authoritative advice that it is appropriate to do so. This PAS will be reviewed at intervals not exceeding two years, and any amendments arising from the review will be published as an amended PAS and publicized in *Update Standards*.

This PAS is not to be regarded as a British Standard.

Supersession

PAS 55-1:2008 and PAS 55-2: 2008 supersede PAS 55-1:2004 and PAS 55-2:2004, which remain current and obsolescent until 1 March 2010 when they will be withdrawn.

NOTE *Obsolescence is declared where the content of a standard, which is superseded by new provisions (in the form of a new standard), still retains a commercial need or relevance (to a specific technology, industry or process). The document is superseded but it is not withdrawn.*

Information about PAS 55:2008

PAS 55-1:2004 and PAS 55-2:2004 have been fully revised as follows:

The revision of PAS 55-1:2004 introduces the following principal changes:

- The term "infrastructure" has been removed from the **title** of the PAS;
- The **Foreword** and **Introduction** have been revised;
- **Figure 1** has been transferred and adapted from PAS 55-2:2004;
- **Figures 2, 4 and 6** have been revised and **Figures 3 and 5** are new;
- New **definitions** have been added, and existing definitions revised;
- Asset management objectives and asset management targets are now jointly referred to as **asset management objectives**, and their definition has been revised accordingly (see **3.5**);
- The section on **Asset management plan(s)** (see **4.3.3**) has been extended to more clearly identify the requirements for optimizing plans and the interaction between life cycle phases;
- The requirements for emergency preparedness and response have been extended to include continuity planning and the section has been renamed **"Contingency planning"** (see **4.3.4**);
- A new section **"Asset management enablers and controls"** (see **4.4**) has been created to consolidate the generic requirements of: structure, authority and responsibilities; training awareness and competence; communication, participation and consultation; asset management system documentation; information management; risk management; legal and other requirements; and management of change;
- New requirements have been introduced for **Communication, participation and consultation** (see **4.4.4**);
- **Information management** (see **4.4.6**) brings together the requirements of the previous clauses for "Document, data and information control" and "Asset management information system";

- **Management of change** is discussed in a separate clause (see **4.4.9**);
- The requirements in the former "Operational control" have been divided between **"Implementation of asset management plan(s)"**, "**Management of change**" and "**Asset management system documentation**";
- **"Implementation of asset management plan(s)"** has been expanded to address the **Life cycle phases** of managing assets (see **4.5**);
- New requirements for **Evaluation of compliance** have been introduced (see **4.6.3**);
- "Checking and corrective action" has been renamed **"Performance assessment and improvement"** (see **4.6**), with the structure for the sub-clauses adapted from those described in PAS 99 and ISO Guide 72; and
- New requirements have been introduced for **Management review** (see **4.7**).

In addition to the above changes made to PAS 55-1:2004, the revision of PAS 55-2:2004 introduces the following principal changes:

- The **Introduction** has been revised;
- **Figures 1, 2 and 3** from PAS 55-2:2004 have been revised and now appear as **Figure 1, 2 and 4** in PAS 55-2:2008. **Figures 3 and 5** are new additions to PAS 55-2:2008;
- New guidance has been introduced for **Contingency planning** (see **4.3.4**); and
- New guidance for **Evaluation of compliance** has been introduced (see **4.6.3**).

Presentational conventions

The requirements of PAS 55-1 are reproduced in outlined boxes. Explanatory guidance, commentary on, and general information about, these requirements is presented in roman (i.e. upright) type. Supplementary notes and further guidance are presented in smaller, italics font.

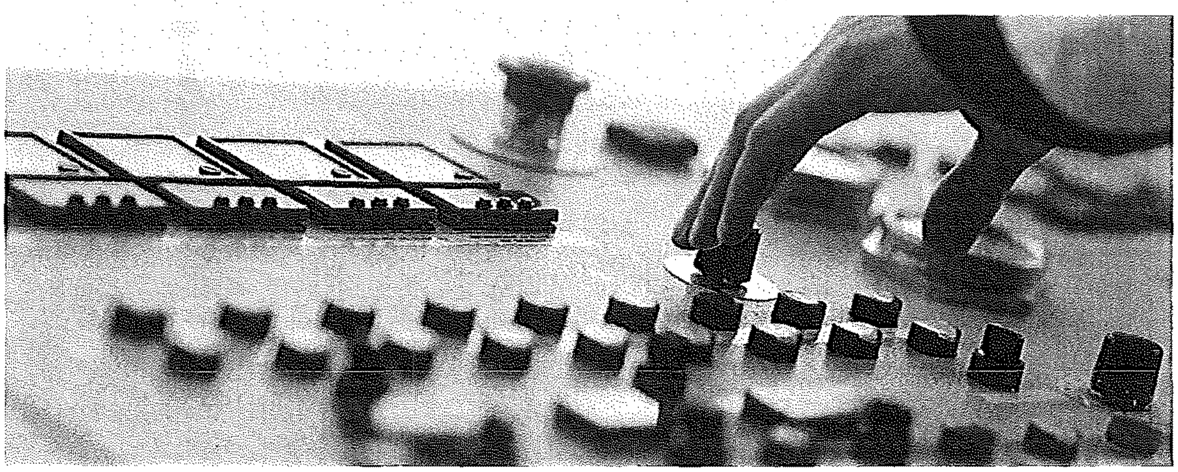
The word "should" is used to express recommendations within PAS 55-2. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this PAS. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this PAS cannot confer immunity from legal obligations.



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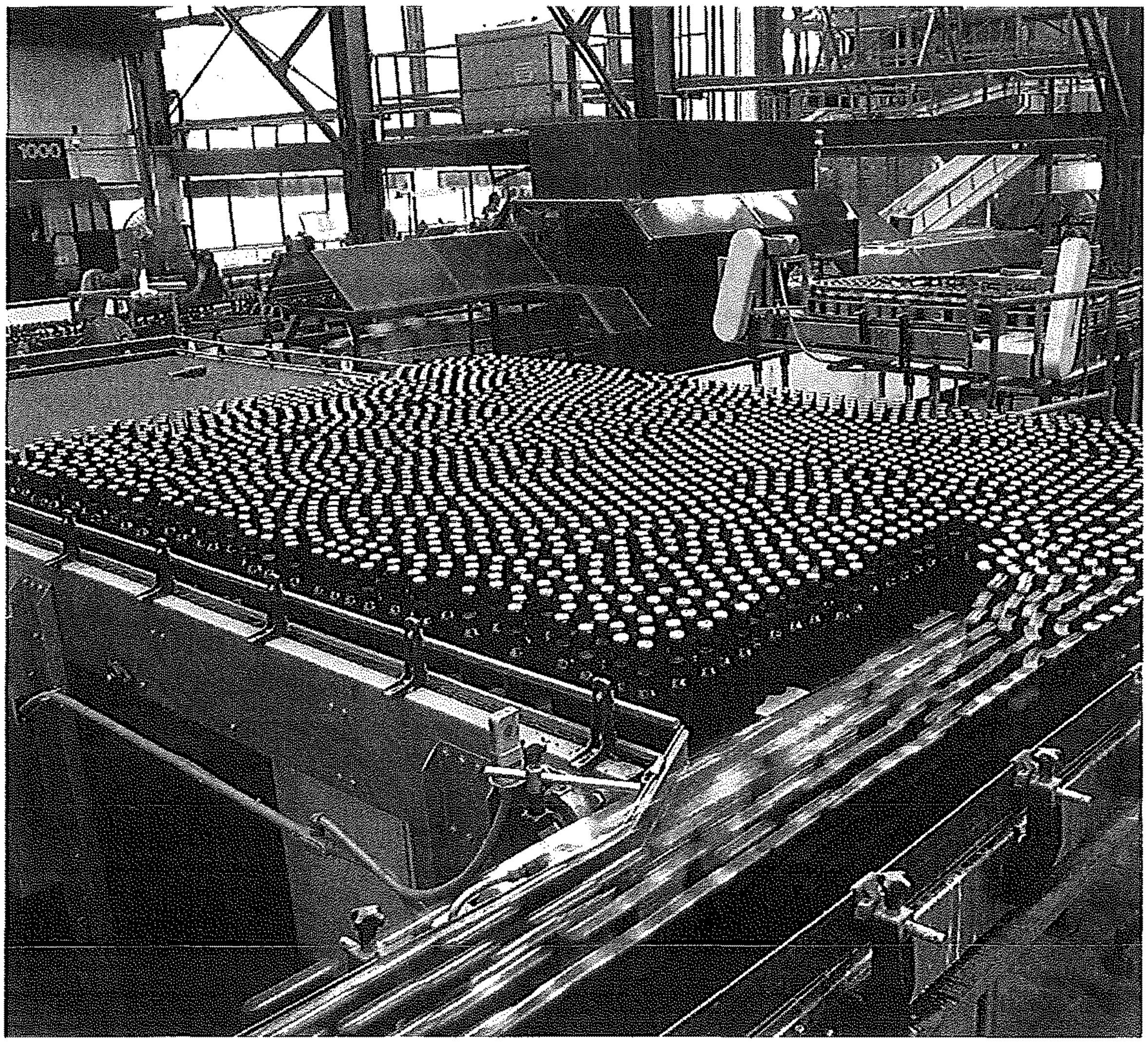
0 Introduction

0.1 What is asset management?

PAS 55-1 defines asset management as:

> *systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan*

This definition of asset management represents a significantly greater scope than just the maintenance or care of physical assets, and is closer to the central purpose of an organization. Good asset management considers and optimizes the conflicting priorities of asset utilization and asset care, of short-term performance opportunities and long-term sustainability, and between capital investments and subsequent operating costs, risks and performance. "Life cycle" asset management is also more than simply the consideration of capital costs and operating costs over pre-determined asset "life" assumptions. Truly optimized, whole life asset management includes risk exposures and performance attributes, and considers the asset's economic life as the result of an optimization process (depending upon the design, utilization, maintenance, obsolescence and other factors).



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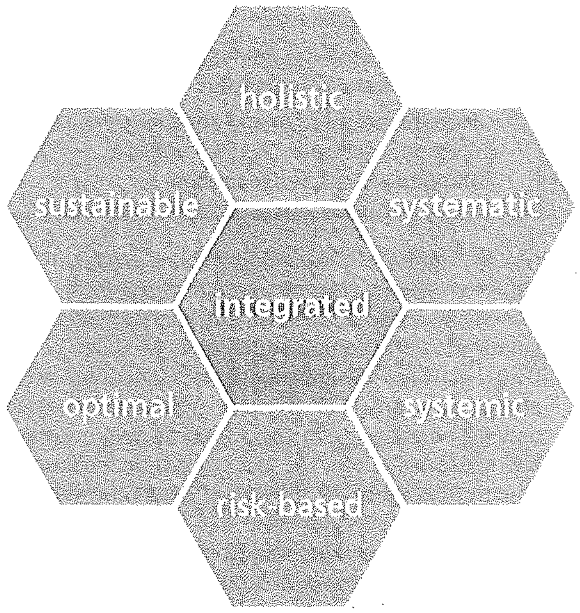
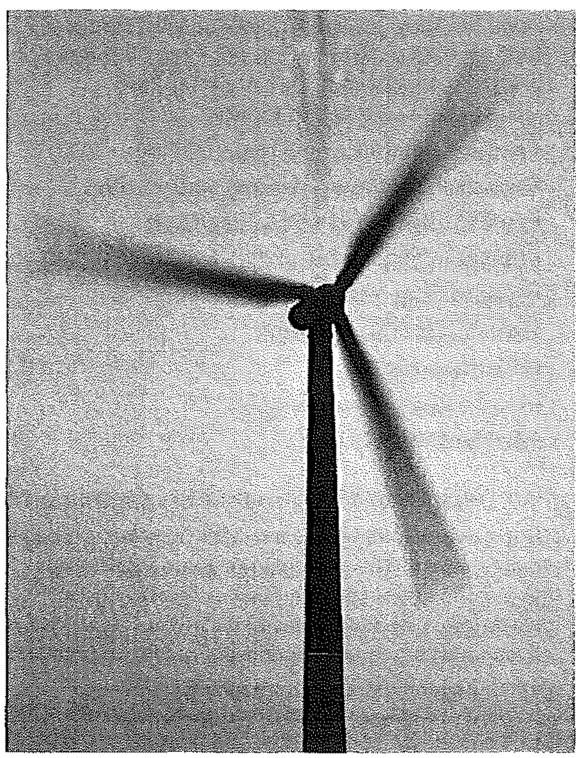
0.2 Dimensions of joined-up asset management

Asset management is an holistic view and one that can unite different parts of an organization together in pursuit of shared strategic objectives. PAS 55-1 identifies key principles and attributes of successful asset management (see **Figure 1**). These can be explained as follows:

- **holistic:** looking at the whole picture, i.e. the combined implications of managing all aspects (this includes the combination of different asset types, see **Figure 3**, the functional interdependencies and contributions of assets within asset systems, see **Figure 4**, and the different asset life cycle phases and corresponding activities), rather than a compartmentalized approach;
- **systematic:** a methodical approach, promoting consistent, repeatable and auditable decisions and actions;
- **systemic:** considering the assets in their asset system context and optimizing the asset systems value (including sustainable performance, cost and risks) rather than optimizing individual assets in isolation;
- **risk-based:** focussing resources and expenditure, and setting priorities, appropriate to the identified risks (see **4.4.7**) and the associated cost/benefits;
- **optimal:** establishing the best value compromise (see **4.3.3.2**) between competing factors, such as performance, cost and risk, associated with the assets over their life cycles;
- **sustainable:** considering the long-term consequences of short-term activities to ensure that adequate provision is made for future requirements and obligations (such as economic or environmental sustainability, system performance, societal responsibility and other long-term objectives);
- **integrated:** recognizing that interdependencies and combined effects are vital to success. This requires a combination of the above attributes, coordinated to deliver a joined-up approach and net value.

Figure 1 – Key principles and attributes of asset management





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0.3 Enablers for good asset management

> The following enabling elements are also considered to be essential for the successful implementation of these principles:
>
> - an organizational structure that facilitates the implementation of these principles with clear direction and leadership;
> - staff awareness, competency, commitment and cross-functional coordination;
> - adequate information and knowledge of asset condition, performance, risks and costs, and the interrelationships between these.

PAS 55-1 indicates that good asset management requires coherent direction and guidance from top management and delivery by appropriately empowered and competent employees. Unless a clearly articulated organizational direction and set of priorities are provided, it is very difficult to determine how best to manage the assets. Conflicting priorities and messages, and/or the lack of staff understanding of such aspirations, or the lack of cross-functional collaboration to deliver them, can lead to inefficient and ineffective working and wasted effort and resources, as well as considerable frustration and de-motivation. For some organizations this may require a change in culture, new behaviours and ways of thinking. There are, therefore, a number of important "enablers" for good asset management (explained further in **4.4**). These have a significant influence on the effectiveness and efficiency of an asset management system and include:

- structure, authority and responsibilities;
- outsourcing of asset management activities;
- training, awareness and competence;
- communication, participation and consultation;
- asset management system documentation;
- information management;
- risk management;
- legal and other requirements;
- management of change.

0.4 Decision making in asset management

Good decision making is also vital in joined-up asset management. This requires adequate information about the assets and their associated strengths, weaknesses, opportunities and threats. In particular, it is important to understand the relationship between asset management activities and their actual or potential effect upon short-term and long-term costs, risks, performance and asset life cycles (or asset system sustainability). Only then can informed decisions be made about the optimal mix of life cycle activities (such as design/selection, acquisition/construction, utilization, maintenance, renewal, modification/enhancement, decommissioning or disposal). In many organizations, there are will be more potential tasks to carry out than resources, time or budgets will permit. The continuous optimizing and prioritizing of tasks and plans are a way of life for such organizations.

There are numerous tools and methodologies associated with asset management that are widely available and employed by organizations. Such tools include *value engineering, life cycle costing, reliability centred maintenance, risk based inspection, total productive maintenance, cost/risk optimization,* etc. However, it is essential for organizations to recognize that good asset management cannot be achieved successfully through the use of these tools alone, and no single such tool can address, control or solve all the problems.

0.5 Asset-related risks

Where possible, performance requirements and significant risks, such as asset failure, need to be quantified in financial terms to enable like-for-like comparison and for the associated expenditure to be set accordingly. For example, in some instances it could be more cost effective to allow an asset to run to failure, whilst in other cases an increase in maintenance expenditure or capital investment might be more appropriate. It is not always possible to place a direct monetary value on the risks or performance associated with asset related expenditure. However, organizations can do so indirectly by turning the question around and asking, for example, "What would we be prepared to pay to avoid harm to our reputation?".

0.6 Sustainability

Sustainable development is an increasingly important consideration within this overall context. In this respect, sustainable development is concerned with ensuring an appropriately long-term approach to economic activity, environmental responsibility and social progress. This is set out more fully in BS 8900.

The reasons for this increasing importance can be found in the strong links between effective asset management and long-term sustainability in several manifestations:

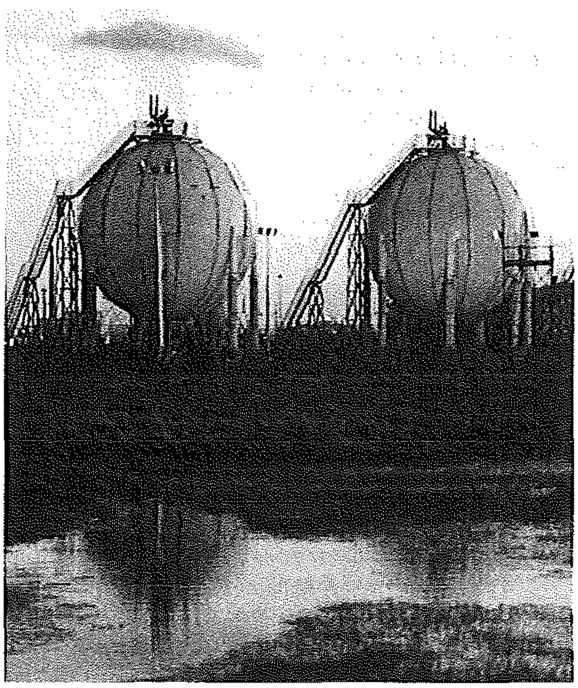
- Effective management of a nation's infrastructure is an underlying component of successful economies. Without appropriate development of this infrastructure over time, the economy will suffer.

- Asset managing organizations can have a huge impact on the environment. This is true from the viewpoint of the raw materials they consume (whether it is water resources, fossil fuels or other raw materials used) or the emissions released in the construction and operation of these assets (both in the form of waste materials and greenhouse gases that may contribute to climate change).
- Physical infrastructure assets provide a foundation stone of societal development, delivering power and warmth, water and sanitation, and the building structures and transport links that allow society to flourish. As such, physical assets are a key enabler for many social structures. Much of this infrastructure is of long life and delivers service from one generation to the next, helping to ensure that these societal structures are enduring.

0.7 Asset management challenges

In order to achieve its organizational strategic plan and provide the assurance its stakeholders seek, an organization needs to ask, and to be able to answer, the following key questions:

- Do we know what (existing) assets we have, where they are, what condition they are in, what function they perform and their contribution to value? Do we know the quality of this information?
- Do we know what we want from our assets in the short, medium and long-term?
- Can our assets deliver our asset management objectives cost effectively?
- Are we getting the most value from our assets? (How could we get more value for money from them?)
- Do we have enough capability (or over capacity) in our asset portfolio? Have some assets or asset systems become redundant, underused, unprofitable or too expensive?
- Are we confident that the risks of our assets causing harm to people and the environment are tolerable and at organizational/legally accepted levels?
- Is our asset-related expenditure (capital investment and operating costs) insufficient, excessive or optimal and correctly assigned across the asset portfolio?
- Can we readily evaluate the benefits (performance, risk reduction, compliance, sustainability) of proposed work or investment and, conversely, quantify the total impact to the organization of not performing such work, not investing or delaying such actions?
- Are we allowing future problems to develop (such as performance deterioration, risks, expenditure requirements) in our efforts to obtain short-term gains?
- Have we given due consideration to the other aspects of the organization that affect our asset management plan(s), such as people, knowledge, finance and intangible assets? Conversely, have we considered the impact of our asset management plan(s) on these other aspects?
- Do we review the appropriateness of our asset management strategy in the light of changes in the operating, regulatory and financial environment?
- Are we continually improving our asset management system performance, and realizing the benefits of the improvements? Do we know what and where improvements will be most effective?
- Do we have the necessary asset management policy, strategy and plan to ensure that we manage our assets in a sustainable way?
- Does our approach to sustainable management of the assets take appropriate account of the needs of our stakeholders and are we open in our communication with these stakeholders?
- Are the working conditions, skills and wellbeing of our employees and contracted service providers given appropriate consideration?
- Are we optimizing our asset management process(es) and/or procedures in the light of the latest developments in technology and innovation?
- Can we answer all of these questions confidently, with a clear audit trail, and demonstrate the answers to our stakeholders?



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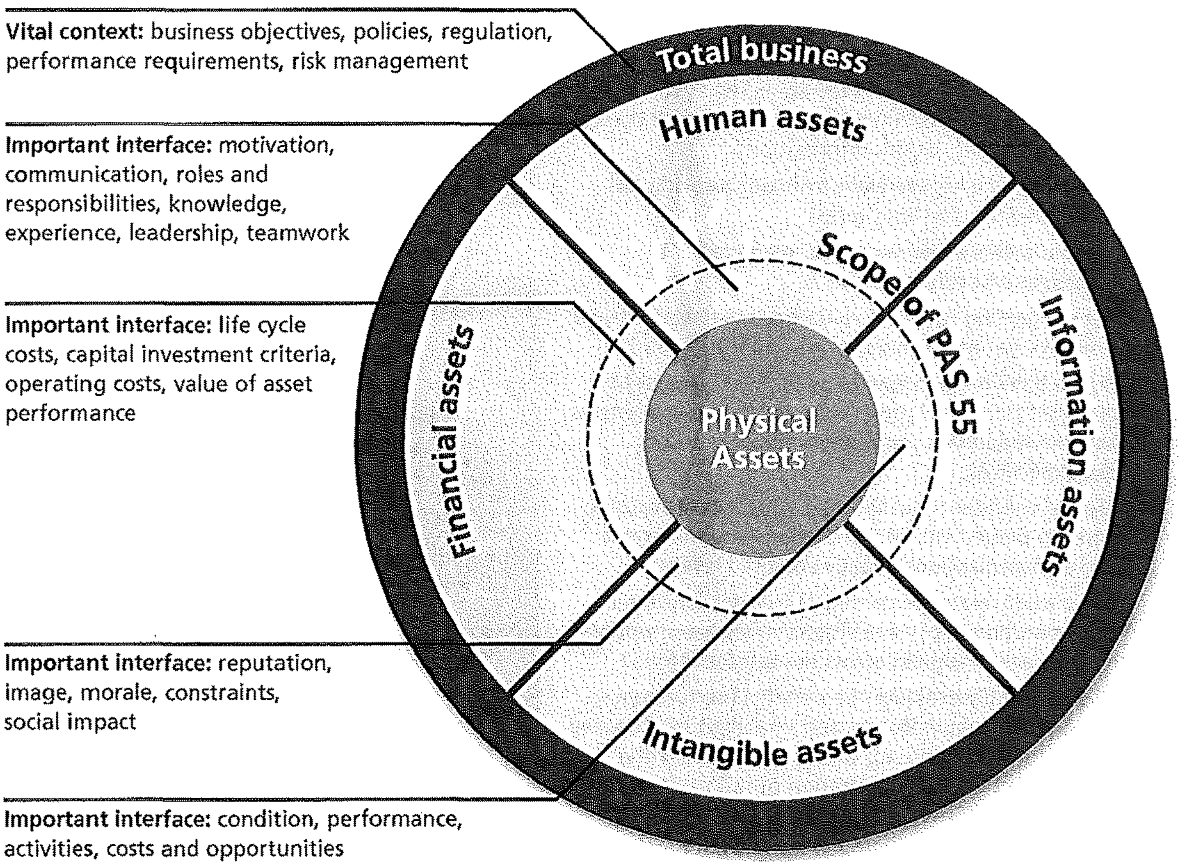
0.8 Types of assets

This PAS is focussed primarily on the management of physical assets, and other asset types are therefore only considered in this PAS insofar as they affect the optimal management of the physical assets. These interdependences are extremely important in the holistic delivery of asset management objectives and, ultimately, the organizational strategic plan. These asset types, the scope of PAS 55, and the vital understanding of business context are illustrated in **Figure 2**. The asset management system should recognize such interdependencies and make appropriate provision for the indirect "enablers" that are required to optimize the value of physical assets. Conversely, organizations that are heavily dependent upon physical assets should also recognize that deficiencies in the management of other asset types may have a profound impact on the overall or long-term performance of their physical assets and thus their organizational performance. Such organizations should recognize that all assets will need to be managed in an integrated and holistic manner.

For example:

- **human assets:** the behaviours, knowledge and competence of the workforce have a fundamental influence on the performance of the physical assets;
- **financial assets:** financial resources are required for infrastructure investments, operation, maintenance and materials;
- **information assets:** good quality data and information are essential to develop, optimize and implement asset management plan(s);
- **intangible assets:** the organization's reputation and image can have a significant impact on infrastructure investment, operating strategies and associated costs.

Figure 2 – Focus and business context of this PAS in relation to the other categories of assets



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0.9 The asset management system

An integrated asset management system is vital for organizations that are heavily dependent upon physical assets in the creation or delivery of their services or products. Large numbers of assets, or diversity characteristics of assets and asset systems, particularly in an environment of conflicting stakeholder expectations, further increase the importance of having a systematic approach to managing the asset portfolio.

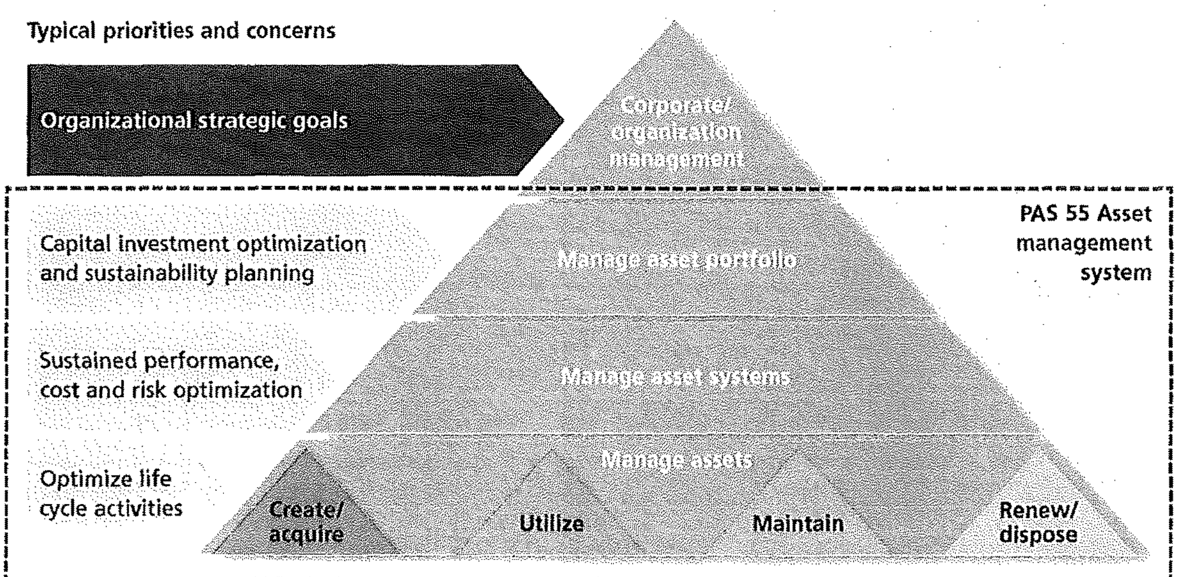
There are different levels at which asset units can be identified and managed – ranging from discrete equipment items or components to complex functional systems, networks, sites or diverse portfolios (see **Figure 3**). Many organizations identify assets as equipment units (sometimes referred to as "maintenance significant items" – the unit at which maintenance tasks or work orders are directed), whereas others use the term to describe functional systems or even integrated business units. It does not matter at what such level an asset unit is identified, provided that:

- the organization's goals and strategic priorities are directly reflected in the asset management plan(s);
- the asset life cycle costs, risks and performance are considered and optimized. (This will usually require definition of clear asset boundaries for measuring performance, life cycle expenditures and attributing associated risks.);
- the aggregations of assets (through integrated asset systems) and contributions of value (as part of the organization's portfolio) are managed in a coordinated and consistent manner;
- all parts of the organization understand and use the same terminology in relation to the assets, their components and their asset system groupings or aggregations.

As explained in PAS 55-1, this hierarchy brings challenges and opportunities at different levels. For example, discrete equipment items may have identifiable individual life cycles that can be optimized, whereas asset systems may have an indefinite horizon of required usage. Sustainability considerations should, therefore, be part of optimized decision making. A larger organization may also have a diverse portfolio of asset systems, each contributing to the overall goals of the organization, but presenting widely different investment opportunities, performance challenges and risks. An integrated asset management system is therefore essential to coordinate and optimize the diversity and complexity of assets in line with the organization's objectives and priorities.

The asset management focus will tend to differ at the various levels of asset integration in an organization. **Figure 3** shows examples of priorities that might be evident at the different levels of asset integration and management.

Figure 3 – Levels of assets and their management



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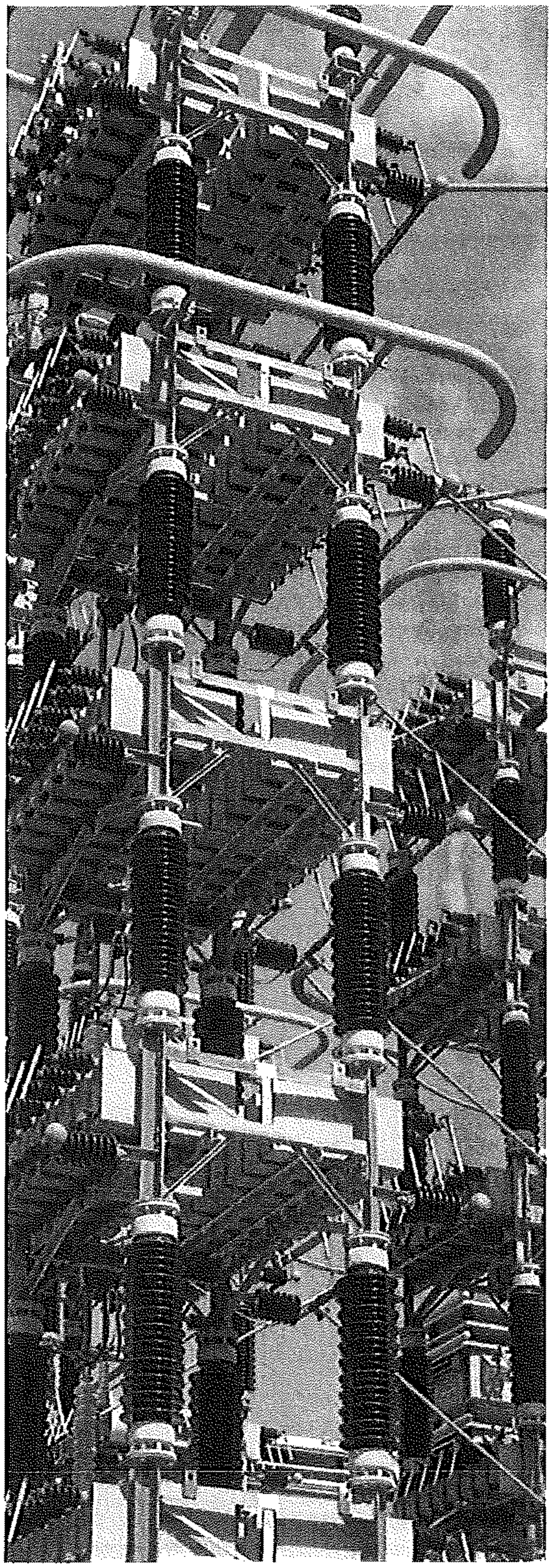

Increasingly, stakeholders (such as customers, the public, regulators and shareholders) are seeking assurance that the asset management system will deliver safety, continuity of service and financial performance. Organizations are ever more sensitive to the impact that adverse public opinion and negative publicity can have on their business when assets or asset systems fail. For most organizations, therefore, establishing, implementing and maintaining a formal asset management system is increasingly becoming a necessity rather than an option, and PAS 55 can facilitate this.

An asset management system is primarily designed to support the delivery of an organizational strategic plan, in turn aiming to meet the expectations of a variety of stakeholders. The organizational strategic plan is the starting point for development of the asset management policy, strategy, objectives and plans. These, in turn, direct the optimal combination of life cycle activities to be applied across the diverse portfolio of asset systems and assets (in accordance with their criticalities, condition and performance). This top-down connective thread is a key feature of an asset management system – the clear "line of sight" from organization direction and goals down to individual, day-to-day activities. Similarly, the bottom-upwards monitoring of asset characteristics, problems, risks and opportunities should provide the factual basis for adjusting and refining realistic asset management strategies and plans, through a process of continual improvement. Furthermore, such asset management realities should inform and influence the expectations of stakeholders and the aspirations of the organizational strategic plan.

The operational elements (**Figure 4** shows such typical elements) and processes of an asset management system should be developed to enable such connectivity, integration, total value optimization and continual improvement.

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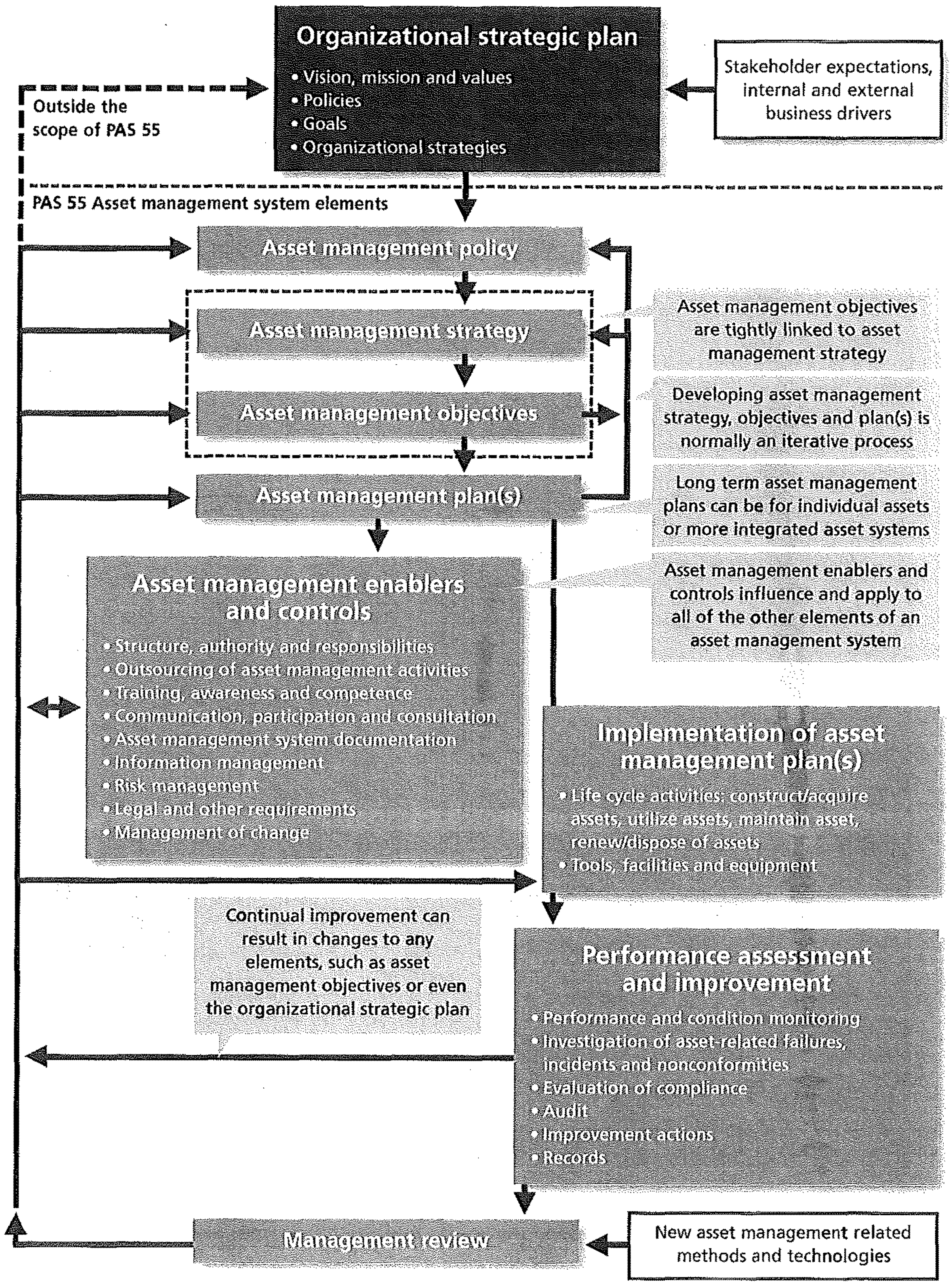
Figure 4 Typical elements of an asset management system



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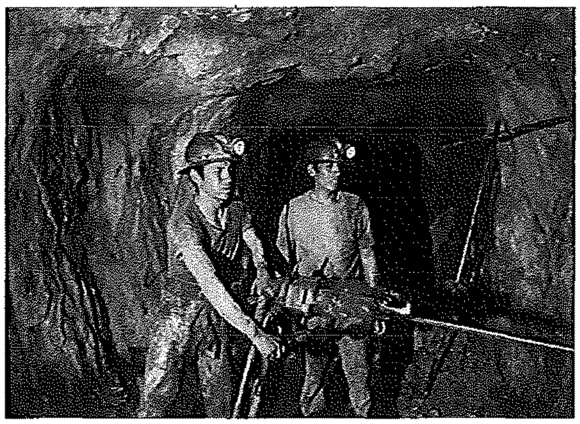
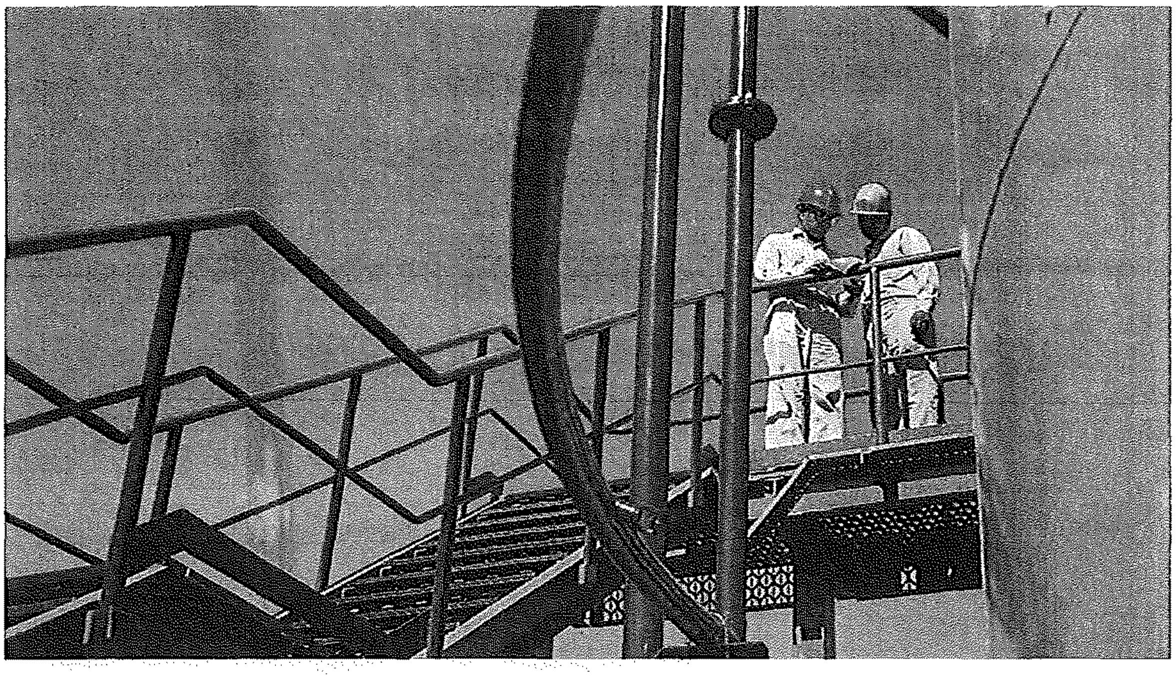
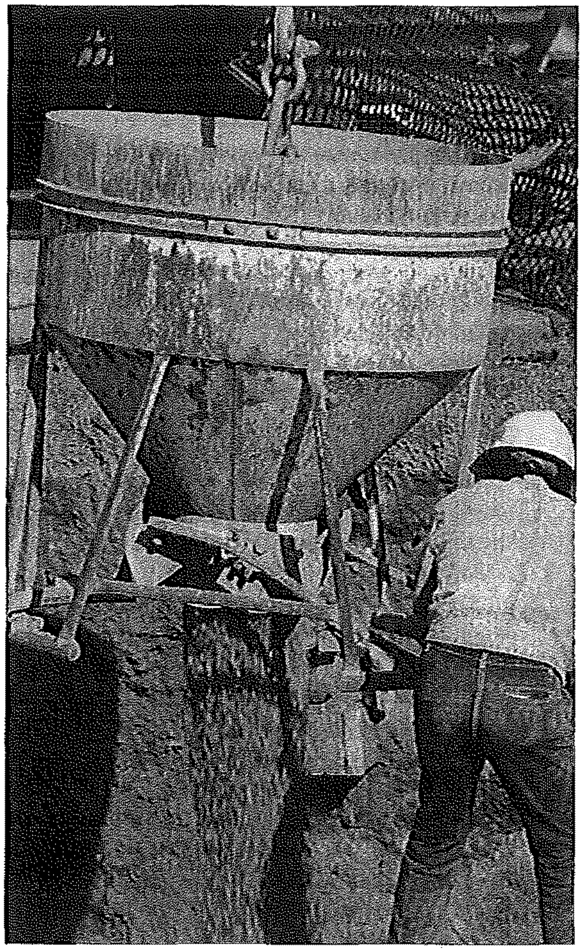
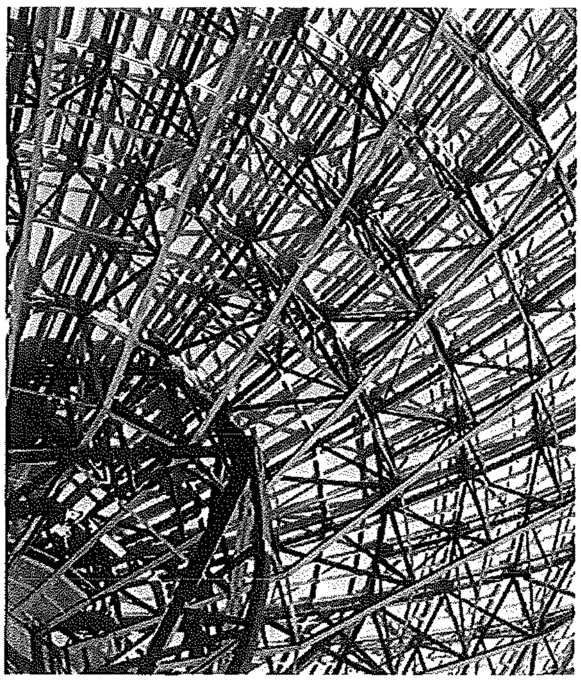
There is no explicit requirement for these elements to be documented separately, and the requirements of PAS 55-1 can be achieved through documents that are not exclusive to asset management. However, the *documentation describing how physical assets will be* managed to achieve the organizational strategic plan needs to be adequately informative and unambiguous. The asset management policy, in particular, mandates the direction, principles and absolute requirements, and is a key driver for the asset management system.









1 Scope

This part of PAS 55 (PAS 55-2) provides guidelines for the application of the requirements specified in PAS 55-1. It provides guidance on the establishment, implementation, maintenance and improvement of an asset management system and its coordination with other management systems.

PAS 55-2 does not prescribe mandatory approaches, methods or tools for the implementation of the requirements of PAS 55-1, but rather aids understanding and implementation by means of examples and illustrations.

This part of PAS 55 does not create any additional requirements to those specified in PAS 55-1.

2 Reference publications

There are no normative references at present (i.e. references indispensable to the full compliance with this PAS).

Informative references (i.e. publications that provide information or guidance) are listed in the Bibliography. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3 Terms and definitions

For the purposes of this part of PAS 55, the terms and definitions given in PAS 55-1 apply.

4 Asset management system requirements

4.1 General requirements

> The organization shall establish, document, implement, maintain and continually improve an asset management system in accordance with the requirements of this PAS.
>
> The organization shall define and document the scope of its asset management system.
>
> Where an organization chooses to outsource any aspect of asset management that affects conformity to the requirements of **Clause 4** of this PAS, the organization shall ensure control over such aspects in accordance with the requirements of **4.4.2**.
>
> ***NOTE*** *This PAS requires that organizations establish, implement and maintain an asset management policy, strategy, objectives and plans.* ***Figure 5*** *illustrates the relationship between the organizational strategic plan and these elements of the asset management system.*

The above requirement is a general statement concerning the establishment and maintenance of an asset management system within an organization. "Establish" implies a level of permanency and the system should not be considered established until all its elements have been demonstrably implemented. "Maintain" implies that, once established, the system continues to operate appropriately – this requires active effort on the part of the organization. Many systems start well but deteriorate due to lack of review and maintenance. Several elements of PAS 55-1 (such as performance assessment and improvement **4.6**, and management review **4.7**) are designed to ensure active maintenance of the asset management system.

An organization seeking to establish an asset management system that conforms to PAS 55-1 should determine its current position with regard to its asset management by means of a review (see **4.1.2**). In determining how it will fulfil the requirements of PAS 55-1, the organization should consider the conditions and factors that affect, or could affect, its asset management; what policies it needs, and how it will manage its asset management risks. The level of detail and complexity of the asset management system, the extent of the documentation, and the resources devoted to it, are dependent on the nature (size, structure, complexity) of an organization and its activities.

4.1.1 Asset management system

Organizations seeking to establish asset management systems that conform to PAS 55-1 should follow the recommendations and guidance provided below.

a) The organization should establish and maintain an asset management system that conforms to all of the requirements of PAS 55-1. This should also assist the organization in meeting legal, regulatory, statutory and other asset management related requirements that are applicable to it.

b) The level of detail and complexity of the asset management system, the extent of documentation and the resources devoted to it are dependent on the size of the organization and the nature of its activities. The system should be of appropriate depth, detail and coverage to enable the organization to meet all of the requirements of PAS 55-1.

NOTE *Some organizations call this an Asset Management Regime or an Asset Management Business Model.*

c) An organization has the freedom and flexibility to define the boundaries of the asset management system and may choose to implement PAS 55-1 with respect to the entire organization, or to specific operating systems or units of the organization. However, care should be taken in defining the boundaries and the scope of the asset management system. The scope of the asset management system should cover the full portfolio of assets that are required for the successful delivery of the organizational strategic plan and not exclude any assets or asset systems that are critical to the business goals.

d) It is likely that the organization's asset management system draws upon processes already in existence and controlled within its quality, environmental and health and safety management systems, etc. While there is no need to establish a separate asset management system in such cases, care should be taken to ensure that processes work together to form an effective overall system, and that there is effective control of this entire system by the relevant management and other personnel.

4.1.2 Review against PAS 55-1

An organization seeking to develop and implement an asset management system which conforms to PAS 55-1 should conduct a review to compare the organization's current management of its assets against the requirements of PAS 55-1 and determine the extent to which these requirements are being met or whether improvements can be made. Such a review should map the requirements of PAS 55-1 against the organization's existing business processes to identify alignments and/or variations in terminology between the two.

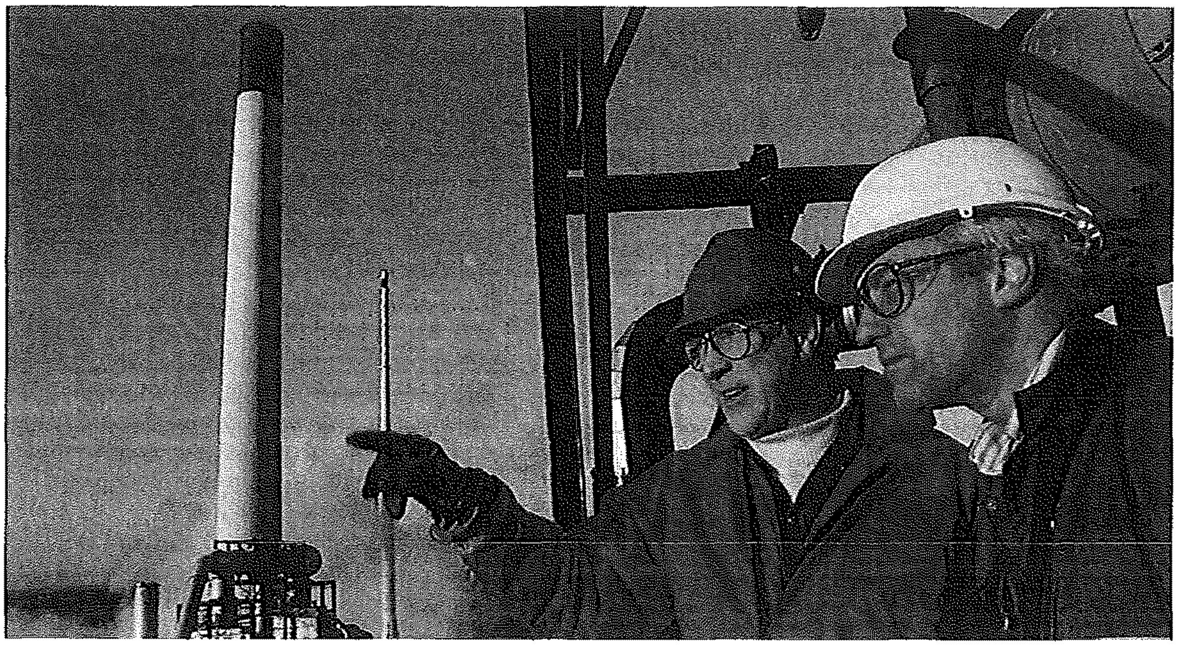
The review will provide information which an organization can use to identify if there are any existing gaps in the asset management system with respect to the PAS 55-1 requirements, and will guide the organization in formulating plans for implementing and prioritizing improvements. Note, however, that compliance with all the requirements of PAS 55-1 represents the *minimum* standard that should be regarded as good asset management practice – it does not represent "best practice", and should not be seen as a limiting goal (some organizations may need or wish to exceed the requirements of PAS 55-1 in their management of assets).

The aim of a review should be to consider how delivery of the organizational strategic plan is supported by, and reflected in the design of, the asset management system. An organization should consider, but not limit itself to, the following items within its review:

- the organizational strategic plan;
- legal, regulatory and other mandatory requirements;
- identification and evaluation of the asset management risks faced by the organization;
- existing asset management practices, process(es) and/or procedure(s);
- the performance of the assets and asset systems (including suitability, utilization, condition, longevity and costs);
- feedback from the investigation of previous incidents, accidents and emergencies;
- relevant management systems, competencies and available resources (internal and external).

A suitable approach to the review can include the use of checklists, interviews, direct inspection and measurement, results of previous management system audits or other reviews depending on the nature of the organization's activities. Where asset management processes already exist, they should be reviewed for adequacy against the requirements of PAS 55-1.

It is emphasized that a review against PAS 55-1 is not a substitute for the implementation of the structured, systematic approach to asset management and adoption of continual improvement processes as described in **4.6** and **4.7**. However, a periodic review can provide additional inputs to the planning of these processes.



4.2 Asset management policy

The organization's top management shall authorize an overall asset management policy.

The policy shall:

a) be derived from, and be consistent with, the organizational strategic plan;

b) be appropriate to the nature and scale of the organization's assets and operations;

c) be consistent with other organizational policies;

d) be consistent with the organization's overall risk management framework;

e) provide the framework which enables the asset management strategy, objectives and plans to be produced and implemented;

f) include a commitment to comply with current applicable legislation, regulatory and statutory requirements and with other requirements to which the organization subscribes;

g) clearly state the principles to be applied, such as the organization's approach to health and safety or sustainable development;

h) include a commitment to continual improvement in asset management and asset management performance;

i) be documented, implemented and maintained;

j) be communicated to all relevant stakeholders, including contracted service providers, where there is a requirement that these persons are made aware of their asset management policy-related obligations;

k) be reviewed periodically to ensure that it remains relevant and consistent with the organizational strategic plan.

NOTE 1 *Organizations may choose to have a detailed asset management policy for internal use which should provide sufficient information and direction to drive the asset management system (parts of which may be confidential) and have a summarized (non-confidential) version for dissemination to its stakeholders.*

NOTE 2 *Organizations may also have one or more functional policies relating to specific asset management activities, such as capital investment, operation, maintenance or contracting. It is essential, however, that alignment is maintained between such functional policies and the overall asset management policy.*

Organizations seeking to implement the requirements of PAS 55-1 on asset management policy, should consider the recommendations and guidance provided below:

a) The asset management policy plays a leading part in driving the asset management system. The asset management policy is a means for top management to communicate to its managers, employees and stakeholders the organization's position and intentions with regard to asset management. It provides a high level statement of the organization's principles, approach and expectations relating to asset management. The asset management policy should be seen as the same level of commitment as an organization's safety policy.

   For example, the policy might start with the following:

   We are committed to maximizing the return on our shareholder's investments through providing high value services to our customers in a legally and environmentally compliant and sustainable manner, without compromising the health and safety of our employees, customers or the public. We shall achieve this by ...

   The asset management policy provides the framework around which the asset management strategy, objectives and plans are developed and implemented. The asset management policy should be drafted in such a way as to be consistent with the organization's overall approach to risk management.

b) Top management should arrange for the production of the asset management policy. The steps to forming, implementing and maintaining the asset management policy would typically be as follows:

   - Identify the requirements of the organizational strategic plan in terms of how it will be achieved through the management of the physical assets, and the principles that should be applied. These should reflect the requirements and potentially conflicting expectations of the organization's stakeholders.
   - The asset management policy should clearly define how it facilitates, supports and enables achievement of the organization's vision, mission and business objectives and align with the organization's other policies (such as safety and environmental policies). It should consider risks, objectives, strategy, constraints, boundaries, timescales and responsibilities.
   - Identify all legal, regulatory, statutory and other top management designated, mandatory asset management requirements (i.e. it is usual to

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include a compliance statement in the asset management policy).

- Develop and agree the draft asset management policy at top management level, ensuring it is consistent with the organizational strategic plan.
- Discuss the draft policy with the organization's relevant managers, employees and other stakeholders. Amend accordingly to achieve an appropriate level of consensus.
- Ensure the policy is worded in a form and style that can be understood by all those to whom it is to be communicated.
- Communicate the asset management policy to the relevant managers, employees and other stakeholders. This can be achieved by posting the document on notice boards, intranet, internet and by face-to-face activities such as briefings, meetings, etc. Many organizations display the policy prominently within their premises. Others use electronic means, e.g. via an intranet. The visible endorsement of top management is important in achieving the appropriate level of attention and commitment.
- Ensure that the asset management policy has been communicated to all relevant personnel, and that it has been understood and accepted, i.e. check understanding throughout the business.
- Ensure that the asset management policy remains relevant and is being complied with. It is essential that the asset management policy remains "alive" and relevant to the changing influences of business drivers and obligations.

c) A policy statement could be used in a court of law, either in favour of the organization or against it. Therefore it would be prudent to have it reviewed by a person who is competent in legal matters.

d) Adherence to the asset management policy is fundamental to the effective, efficient and safe management of an organization. Top management should therefore provide adequate arrangements (such as resources, communication, facilities, supervision and training) to ensure that the asset management policy is adhered to.

e) It is important that, when developing its asset management policy, an organization considers the issues of sustainable development – an enduring, holistic approach to economic activity, environmental responsibility and social progress. It should also consider how it can maintain an appropriate trade-off between long- and short-term requirements. The growing importance of climate change and its associated risks should not be underestimated in doing so.

f) The asset management policy should be regularly reviewed, at a frequency determined by the organization, and following significant changes to the operational context of the organization. Issues identified should be addressed and changes, where appropriate, should be implemented. These reviews serve two purposes:

- to ensure that the asset management policy is current and effective;
- to ensure that the policy is continuously improved in light of developments in appropriate fields such as technology, operations, asset care techniques, etc.

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4.3 Asset management strategy, objectives and plans

4.3.1 Asset management strategy

The organization shall establish, document, implement and maintain a long-term asset management strategy which shall be authorized by top management.

NOTE *The time horizon for a long-term asset management strategy would normally be aligned with that of the organizational strategic plan.*

The strategy shall:

a) be derived from, and be consistent with, the asset management policy and the organizational strategic plan;

b) be consistent with other organizational policies and strategies;

c) identify and consider the requirements of relevant stakeholders;

d) consider the life cycle management requirements of the assets;

e) take account of asset-related risks (see **4.4.7**), asset and asset system criticalities;

f) identify the function(s), performance and condition of existing asset systems and critical assets;

g) state the desired future function(s), performance and condition of existing and new asset systems and critical assets, on timescales aligned to those of the organizational strategic plan;

h) clearly state the approach and principal methods by which assets and asset systems will be managed;

NOTE *This may include, for example, the criteria to be adopted for determining asset criticality and value, the life cycle and sustainability basis for asset management planning, the approach to asset risk and reliability management and the methods of optimization and decision-making.*

i) provide sufficient information, direction and guidance to enable specific asset management objectives and asset management plan(s) to be produced;

j) include criteria for optimizing and prioritizing asset management objectives and plans;

k) be communicated to all relevant stakeholders, including contracted service providers, where there is a requirement that these persons are made aware of their asset management strategy-related obligations;

l) be reviewed periodically to ensure that it remains effective and consistent with the asset management policy and organizational strategic plan and with other organizational policies and strategies.

Organizations seeking to implement the requirements of PAS 55-1 on asset management strategy, should consider the recommendations and guidance provided below:

a) The asset management strategy should set out how the asset management policy will be achieved. It is the co-ordinating mechanism for ensuring that activities carried out on physical assets are aligned to optimally achieve the organizational strategic plan. This requires a high level plan or scheme for converting the asset management policy into specific asset management objectives and activity plans across the whole asset portfolio.

b) The asset management strategy should describe, at a high level, the mechanisms for achieving the requirements of PAS 55 throughout the activities of the business (including the methods of prioritization, optimization, sustainability and risk management). Where appropriate, this should also include reference to required performance and condition requirements for assets, or provide guidance to ensure that these are set out in derived asset management objectives and associated procedures or functional specifications.

c) The asset management strategy should make reference to improvement programmes, and provide long-term guidance on continuous improvement. The duration of "long-term" will be dependent on the asset management policy and will vary from one organization to another and from one industry sector to another.

d) The asset management strategy is often set out in terms of the major business functions (or organizational goals), natural groupings of the asset portfolio (for example, sites, areas or business units) or in terms of logical asset life cycle phases, ensuring the co-ordination and alignment of activities, processes and enablers (such as asset information).

e) The asset management strategy should include references to strategic approaches to be adopted to enable the delivery of the asset management policy, such as whole -life costing, risk management and sustainability. This should be sufficiently detailed to enable their consistent and integrated application across the asset management system, and to provide adequate guidance for application through operational documents such as functional policies, and the development of appropriate improvement initiatives.

f) The asset management strategy should be realistic, well thought out, appropriately detailed and it should take account of the views of all relevant stakeholders. Failure to do this could lead to unnecessary or inappropriate work being done, or failure to meet key business objectives.

g) When establishing and reviewing its asset management strategy, the organization should ensure that it is derived from, and consistent with, its asset management policy, organizational strategic plan and other organizational strategies. The organization should also consider the following items:
   - stakeholder requirements/expectations that influence the management of the assets (including legal, regulatory, statutory and other asset management requirements);
   - the previous asset management strategy, if applicable, and any need for a transition plan;
   - existing asset management plan(s), if applicable;
   - changes in priorities that the organization is aware of, or that might arise in the future;
   - the forecast demand for the service or the product (including demographic and geospatial information and relevant trends);
   - the predicted availability and cost of necessary resources, raw materials and essential supplier services;
   - asset-related risks;
   - the physical condition of the assets, age profile, flexibility and suitability for the desired usage;
   - asset deterioration mechanisms, and failure modes and effects;
   - historical asset-related information such as reliability, maintenance records, operational performance and condition data;
   - criteria for capital investments and for comparing options;
   - methods for determining optimum operating and maintenance strategies, including resources, task justifications and intervals, process(es) and/or procedure(s) and standards;
   - methods for efficient delivery of work and resources, such as work management systems, project and resource planning;
   - constraints including legal, regulatory, statutory, financial, resources, physical access, logistics and timescales;
   - the results of benchmarking, audit results and assessments of current and best practices;
   - the results of the management review (see **4.7**);
   - scenario planning, "what if?" analysis, and contingency planning, i.e. considering the effects of unexpected events and possible responses. Scenario planning can become a complex task, therefore the organization should use appropriate tools and techniques;
   - sensitivity analysis: changing the values of key variables and assumptions in order to determine which are the most sensitive to fluctuations, thereby identifying risks and any requirements for improving the accuracy of the analysis. Organizations should use appropriate tools and techniques to carry out sensitivity analysis;
   - opportunities to achieve the asset management strategy in a more cost effective way, i.e. attaining the same objective at lower costs without compromising sustainability or risk exposure levels. Such opportunities can be identified through advances in technology, management practices, contractual arrangements, partnering, etc.;
   - opportunities to add value, i.e. increasing the worth of an asset/asset system compared to its costs, e.g. generating income from sharing an underused asset/asset system with another operator.

h) The asset management strategy should demonstrate how the asset management policy is to be implemented and how it will support the organizational strategic plan. It should include the following items:
   - the desired outcomes related to the existing or new asset(s);
   - the summaries of broad plans and programmes to achieve these desired outcomes with defined timescales and responsibilities. These should also include details of the resources that are needed to deliver the plans and the actions required to secure them;
   - the assumptions made and financial costing if appropriate;
   - the targets against which the performance of the asset management strategy can be measured (see **4.6.1**).

i) The means to effectively measure and report the performance and success of the asset management strategy should be described. In addition to targets, organizations should use a coordinated set of key performance measures to help them achieve this.

j) The following is an example of a typical asset management strategy, derived from an organization's business strategy:

Business strategy

To improve the current profit before tax by 15% within a period of 3 years through expanding capacity to meet the predicted 10% increased customer demand, funded through private finance, which will be repaid through future profits.

Corresponding asset management strategy

To upgrade the core infrastructure, to meet the increased demand, by efficiently investing up to £XXm investment over the next 5 years and development and implementation of optimal operating and maintenance strategies.

4.3.2 Asset management objectives

The organization shall establish and maintain asset management objectives, which shall:

a) be measurable (i.e. quantified and/or capable of being demonstrated as achieved through objective assessment);

b) be derived from, and consistent with, the asset management strategy;

c) be consistent with the organization's commitment to continual improvement;

d) be communicated to all relevant stakeholders, including contracted service providers, where there is a requirement that these persons are made aware of their obligations;

e) be reviewed and updated periodically by the organization to ensure that they remain relevant and consistent with the asset management strategy;

f) consider legal, regulatory, statutory and other asset management requirements;

g) take account of the expectations of relevant stakeholders and financial, operational and business requirements;

h) take account of asset management related risks;

i) consider improvement opportunities including new technologies and asset management tools, techniques and practices (see **4.6.5.2**).

NOTE *Objectives may be set for the asset management system, asset management activities and/or the performance or condition of asset systems or assets.*

Organizations seeking to implement the requirements of PAS 55-1 on asset management objectives, should consider the recommendations and guidance provided below:

a) It is necessary to ensure that measurable asset management objectives are established throughout relevant parts of the organization to enable the asset management policy to be implemented and the asset management strategy to be achieved.

b) Asset management objectives should be derived from, and be consistent with, organizational objectives.

c) Using pertinent information or data, appropriate levels of management should identify, establish and prioritize asset management objectives. During the establishment of asset management objectives, consultation with those most likely to be affected should assist in ensuring that the objectives are reasonable and more widely accepted. To help ensure achievable asset management objectives are set, it is also useful to consider information or data from sources external to the organization, for example, contractors, key suppliers or other stakeholders.

d) Asset management objectives should be kept to a limited number of clear goals and should be as "SMART" as possible, i.e.:

   Specific

   Measurable

   Achievable

   Realistic

   Time-based

e) Care should be taken not to set asset management objectives without due consideration of the cost (including lost income) of achieving those objectives. Potential conflict between objectives should also be identified and resolved. This will involve consideration of the business impact for each objective, and optimization (see **4.3.3.2**) to determine the best value combination of partial achievements.

f) The following provides an example of two asset management-related objectives developed within the same organization:

   To satisfy a 10% demand growth within three years, and provide a minimum of 15% return on investment, without compromising health and safety.

   Timetables that deliver a train every five minutes in central areas and every 10 minutes elsewhere – all day, every day.

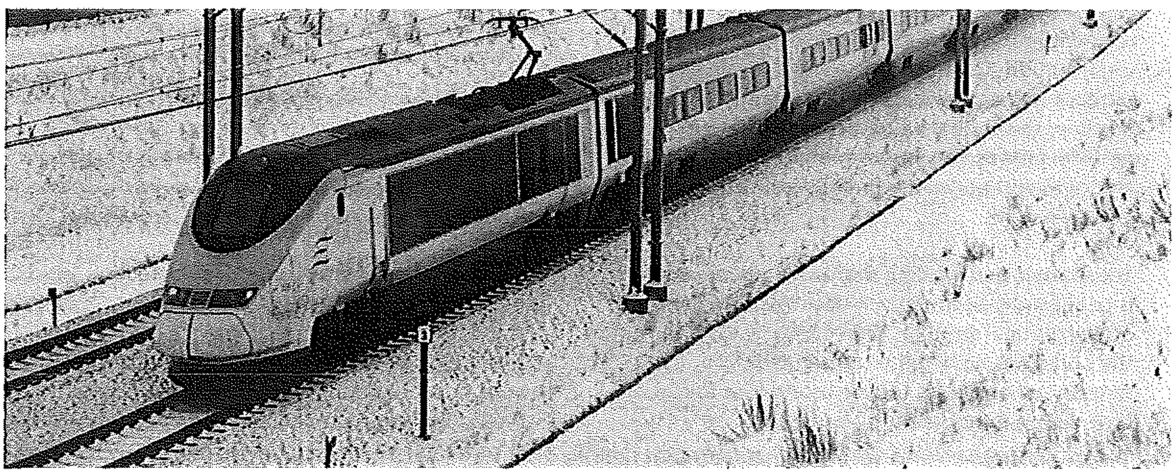
   Using the above examples as illustrations, the organization should ensure that:

   - the objectives are achievable, i.e. they are technically feasible, affordable, resources capable, timescales viable, etc.
   - any inherent conflict is resolvable, i.e. the expenditure and resources necessary to deliver the stated service (train every five minutes) will not prevent the organization from achieving a "15% return on investment". "Stretch" targets are valuable, provided that those charged with achieving them can be persuaded of their achievability.

g) Wherever possible, ratios of output to cost or input (such as the unit cost of service or product) are preferable. Objectives (or targets) set without due consideration of the associated cost/income might be counterproductive and act to the overall detriment of the organization. Similarly, absolute requirements on maximum expenditure, or reductions in costs, should be avoided as they can lead to unnecessary lost opportunities or false economies. However, it is acknowledged that in certain circumstances it will be impracticable to set objectives as ratios, and absolute requirements will be appropriate (such as those driven by new legislation).

h) Asset management objectives may take the form of specific performance and condition targets, these are discussed further below.

The asset management performance and condition targets should translate the organizational strategic plan and associated asset management policy, strategy and objectives into practical measures that can be achieved and maintained through asset management plan(s) and operational control. Targets should be optimized in terms of asset performance and/or condition, cost and retained risk. Optimized performance and/or condition targets should be established through an iterative process between the asset management policy, strategy and objectives.



However, organizations should also consider that any changes, such as those to the asset management plan(s) and operational control, can affect the optimized targets. This might require the targets to be re-optimized.

Without a clearly defined organizational strategic plan and the associated asset management policy, strategy and objectives, it is difficult to set appropriate and realistic performance/condition targets for the assets.

Asset performance/condition targets can be measures of:

- service/supply standards;
- levels of service/supply;
- reliability, availability, maintainability;
- functionality;
- survivability;
- capacity, output quantity, output quality;
- customer satisfaction;
- safety and/or environment impact;
- legislative, regulatory or statutory compliance or a combination of the elements above.

Performance targets should be aligned with, and provide adequate coverage of, business objectives.

Care should be taken in defining performance targets that focus on isolated aspects of performance. Many of the potential metrics for an asset management system refer to interrelated behaviours of the system, whose net effects should be addressed using an holistic approach. Poor definition of performance targets might encourage individual activities to be managed in isolation, without due consideration of their impact on overall system performance and to the overall detriment of the organization.

For example, a target focussed solely on maintenance expenditure might encourage efforts to reduce this cost, without due regard to the impact on the organization that might arise from any resulting increase in plant failures and downtime. Where possible, this should be addressed by defining performance targets in the form of ratios, such as cost of maintenance per unit of production/uptime/service/income.

The essence and challenge of asset management is to align the performance of the assets with the organizational strategic plan. In order to achieve this, the objectives have to be translated into practical targets and measures for the assets. The following provides an example of this process:

Asset management objective: timetables that deliver a train every five minutes in central areas and every 10 minutes elsewhere – all day, every day.

Achieving this objective would require:

- a certain number of trains with a specified level of availability;
- a specified level of availability of the infrastructure system including track, signals, switching gear, power, etc.;
- scheduling systems and resources to ensure appropriate operators, train dispatch and timing controls.

The optimum level of availability for such a complex system could be best determined through simulation modelling. The output of such modelling would provide optimum availability targets for individual components (train, track, signals, etc.) and for the whole system. Therefore the output of such analyses would be the performance target for a component asset/asset system and might be similar to the following:

To achieve an average of 97% system availability on the route.

Such an availability target assumes reliability characteristics for each component of the system, normally expressed as Mean Time Between Failure (MTBF) or Mean Time To Failure (MTTF) and Mean Time To Repair (MTTR). Such component characteristics may be estimated directly, or calculated from reliability studies, risk assessments, deterioration modelling or optimization studies.

System performance modelling in this manner can:

- establish whether an objective is realistic;
- establish optimized plans for achieving its objectives (including design specifications, maintenance schedules and capital investments);
- identify the assets (or their components) that are critical to achieving the objective;
- determine the probable total cost of achieving such an objective;
- provide a baseline against which to measure actual performance (thereby verifying/updating assumptions and improving future prediction accuracy).

Other factors also have to be considered in determining and achieving the availability of the system, such as human performance, resources, knowledge, skills, motivation/culture and cash flow constraints. However, these can all be taken into account during the modelling process, and explored for potential business impact or sensitivity.

4.3.3 Asset management plan(s)

The organization shall establish, document and maintain asset management plan(s) to achieve the asset management strategy and deliver the asset management objectives across the following life cycle activities:

a) creation, acquisition or enhancement of assets;

b) utilization of assets;

c) maintenance of assets;

d) decommissioning and/or disposal of assets.

NOTE 1 *Creation, acquisition or enhancement includes design, modification, procurement, construction and commissioning.*

NOTE 2 *Maintenance also includes inspection, condition monitoring, functional testing, repair, refurbishment, and/or life extension of assets. Replacement of individual assets may also be considered as maintenance of asset systems.*

NOTE 3 *Asset management plan(s) can be for individual assets, asset types, asset systems, whole asset portfolios and/or the overall asset management system. However, it is essential that the plans are clearly linked to the asset management strategy and objectives that they are intended to achieve.*

The development of asset management plan(s) and life cycle activities shall include consideration of the impact of actions in one life cycle phase upon the activities necessary in other life cycle phases.

The asset management plan(s) shall be optimized and the actions prioritized. Multiple plans (for example, covering a portfolio of asset systems or assets) shall be jointly optimized and prioritized, taking into account overall value, resource requirements, interdependencies, risks and performance impact.

NOTE *Developing, optimizing, prioritizing and integrating asset management plan(s) are iterative processes that start with the development or update of the asset management strategy.*

The asset management plan(s) shall include documentation of:

a) the specific tasks and activities (actions) required to optimize costs, risks and performance of the assets and/or asset system(s);

b) the designated responsibilities and authorities for the implementation of such actions and for the achievement of asset management objectives;

c) the means and time scales by which these actions are to be achieved.

The asset management plan(s) shall be communicated to all relevant stakeholders to the level of detail appropriate to their participation or business interests in the delivery of the plan(s).

In the development of asset management plan(s), the organization shall ensure that appropriate arrangements, functional policies, standards, process(es) and/or procedure(s), asset management enablers and resources are made available for the efficient and cost effective implementation of the plan(s).

NOTE *It is essential that the plan(s) are realistic and can be implemented.*

The asset management plan(s) shall include actions to improve the asset management system (see **4.6.5** and **4.7**).

The asset management plan(s) shall be reviewed periodically by the organization to ensure that they remain effective and consistent with the asset management strategy and objectives.

4.3.3.1 General

Organizations seeking to implement the requirements of PAS 55-1 on asset management plan(s), should consider the general recommendations and guidance provided below:

a) The asset management plan(s) should identify the various tasks that need to be implemented in order to meet each asset management objective. They should provide for the allocation of appropriate responsibility and authority for each task and allocate timescales to each individual task, in order to meet the overall timescale of the related asset management objective. They should also provide for the allocation of suitable resources (e.g. financial, human, equipment, logistics) for each task.

b) When establishing and maintaining its optimized asset management plan(s), an organization should consider:

- the asset management policy and strategy;
- existing asset management objectives and performance and condition targets;
- risk management (see **4.4.7**);

- historical and predicted asset condition, deterioration and failure mechanisms, and performance profiles;
- uncertainty in data, knowledge and planning assumptions (this should be reflected in the risk assessment, and in the review or updating of the plans and future data collection requirements);
- life cycle costs;
- financial and resource capabilities or constraints;
- legal, regulatory, statutory and other asset management requirements;
- scheduling constraints, seasonality and other business environment variables;
- lead times for manufacture, obtaining customer information, planning consents, funding approvals, etc;
- programming works, mobilization and access to the asset or to a scarce or key resource;
- improvement objectives;
- results of the management review (see **4.7**);
- opportunities for achieving the asset management plan(s) in a more cost effective way (that might have been missed during the strategic planning stage or not available then), i.e. achieving the same objective/level of required performance/ condition for lower costs without compromising sustainability or risk exposure levels. Such opportunities can be identified through the optimization process, tactical planning, availability of discounts on goods and services, etc.;
- opportunities for adding value (where appropriate and which might have been missed during the strategic planning stage or not available then), i.e. increasing the worth of an asset/asset system compared to its costs. Provided it is desirable overall for the organization to do so, it should look for ways to increase productivity without increasing costs or compromising sustainability or risk exposure levels.

c) Asset management plan(s) should be produced with due regard for their broader impact on the business. Failure to consider the full impact of asset management decisions can have adverse effects such as:

- poor environmental performance (e.g. from out-dated technology) adversely affecting the organization in terms of regulatory or statutory penalties, loss of reputation and business and increased scrutiny of the organization's asset management;
- extensive downtime for maintenance, etc. resulting in poor service to customers;
- loss of essential expertise or knowledge from within the organization through outsourcing of critical activities;
- increased health or safety risks to personnel (e.g. exposing personnel to a hazardous environment instead of employing available and cost-effective remote technology);
- additional cost or lost income due to the poor timing of planned activities;
- plans that are unachievable in the timescale required because they were produced without the appropriate involvement of third parties such as suppliers or contractors.

d) Those who have responsibility for delivering the management plans should be clearly identified. Many organizations define this responsibility within job descriptions, whilst others include specification of responsibility for delivering the asset management plan(s) with the plan itself.

e) Asset related performance, expenditure and risk should be jointly managed and planned to establish their combined impact on the business. Appropriate methods of evaluating and optimizing the trade-offs between these elements should be employed.

f) The asset management plan(s) should include long-term asset replacement programmes to provide an overview of future asset replacement requirements and associated funding needs so that replacement alternatives and expenditure smoothing can be planned ahead.

g) Conversely, plans generated from other management systems can have an adverse impact on the asset management plan(s) and also require due consideration, e.g. a sales plan committing the organization to a level of output that is unsustainable and does not allow for necessary maintenance activities to be adequately carried out.

4.3.3.2 Optimization of asset management strategy and plans

A key feature of good asset management strategy and plans is the optimization of costs, risks and performance over short and long timeframes, in the face of conflicting stakeholder expectations. The processes of optimization are critical, therefore, to the quality of the asset management strategy and the effectiveness and efficiency of asset management plan(s).

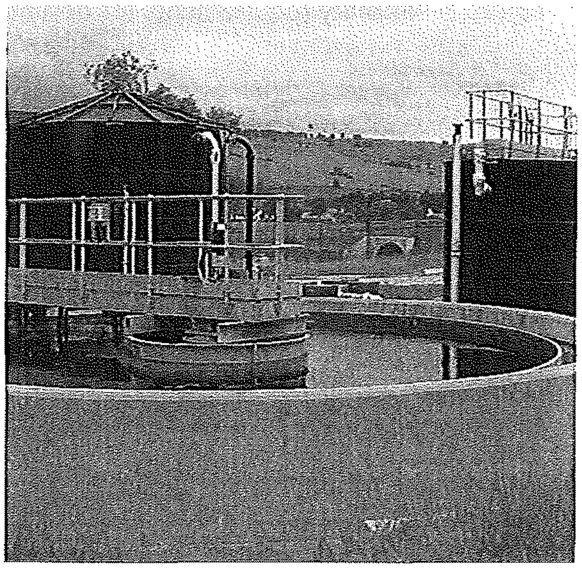
When optimizing their asset management strategy and plans, organizations should consider the recommendations and guidance provided below.

a) Organizations should adopt robust and auditable methods for optimization, appropriate to the criticality and complexity of the decisions being made, and ensure consistent assumptions about the significance of contributing factors.

b) Optimization involves processes of:
  - identifying all factors that can influence the required strategy or decision;
  - determination of their significance (including interdependencies and conflicting objectives);
  - analysis of trade-offs, alternative decision options and scenarios, including sensitivity to the uncertainty in data or assumptions;
  - selection of the best value compromise within any non-negotiable constraints or obligations.

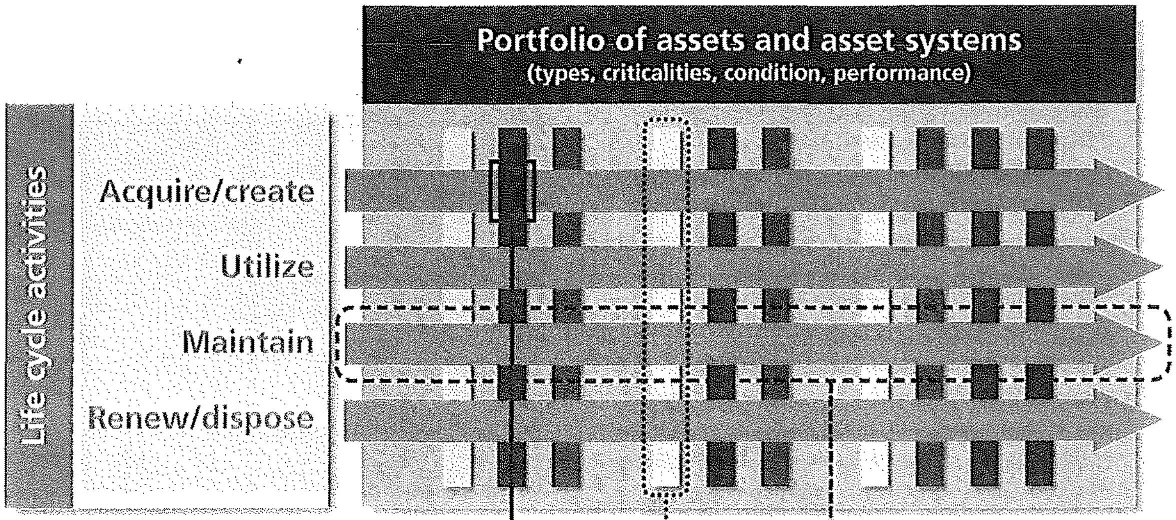
c) The best value compromise should be considered as the strategy or decision that results in the lowest combination of life cycle costs, risks, performance or service losses and other negative effects on business goals (such as damage to reputation or sustainability). This optimization criterion is sometimes known as the "Total Cost of Ownership" or "Total Business Impact". Care should be taken to determine the appropriate weighting, significance or criticality of contributing factors to this total "cost" or "impact", and to communicate and explain the optimization results to stakeholders in terms of the compromises that are necessarily involved. Organizations should be careful, for example, to avoid the language and concepts of "balancing" costs and risks: the balance point (equal significance or impact) is not the same as the optimal combination (lowest combined cost or impact).

d) An organization should develop the criteria for optimization and prioritization from the organization's strategic values and goals, through a "top down" determination of criticality and appropriately weighted objectives. The practical evaluation, however, of "what is worth doing, when" should be developed through a "bottom up" approach, starting with the optimization of specific tasks or interventions on discrete assets, and building up to the optimal coordination of all life cycle activities for an asset or asset system, and finally to the optimal programming of multiple activities across multiple assets. **Figure 5** shows how these three major areas of optimization apply to an asset portfolio. These represent optimization of:
  - individual interventions or actions upon individual assets (such as "*Is this maintenance task on this equipment item worthwhile and, if so, when?*");
  - task combinations on the same asset, or different assets within an asset system:



    - the various life cycle activities for the same asset, i.e. the best combination of investment, utilization, maintenance and renewals. For example, there may be an interaction between the optimal cleaning cycle for a heat exchanger and the economic life of the heat exchanger tubes (due to cumulative damage caused by the cleaning process.);
    - the activities on various components of an asset system where interdependencies exist, such as train wheel-rail interfaces, air conditioning or cooling systems and the equipment/facilities they are protecting.
  - activity programme delivery, such as critical path identification, resource levelling and work bundling (for example, shutdown strategies, where there may be benefits for combining tasks to share access opportunities or other overheads).

Figure 5 – Primary requirements for optimization of asset management activities



1. **Specific intervention** optimization
   (cost/benefit/risk/timing)

2. **Asset life cycle** optimization
   (cost/performance/risk/sustainability)
   a) Individual assets (whole life cycles)
   b) Asset system integration level (performance sustainability)

3. **Activity programme** optimization
   (cost/benefit/risk/timing of multiple activities across multiple assets)

e) The level of precision, the method and the resources applied for optimizations should be proportionate to the criticality and complexity of the individual cases. Optimization methods may be qualitative or they may be quantitative, in which case the optimization should also include the correct mathematical treatment of reliability and risk elements, and of the trade-off between conflicting factors in order to identify the best value compromise.

4.3.4 Contingency planning

The organization shall establish, implement, and maintain plan(s) and/or procedure(s) for identifying and responding to incidents and emergency situations, and maintaining the continuity of critical asset management activities.

In developing its plan(s) and procedure(s), the organization shall consider:

a) asset-related risks that, if realized, could result in incidents or emergency situations;

b) potential disruptions to its critical asset management activities;

c) the most appropriate actions for responding to an incident or emergency situation, and mitigating the likely consequences;

d) the competence and training of personnel required to respond to emergencies;

e) the needs of relevant stakeholders who may be affected by incidents or emergency situations, or who may be required to support the organization to respond to such events.

The plan(s) and/or procedure(s) shall identify how the organization will respond to, and manage, incidents and emergency situations, and shall include information on:

1) essential personnel, emergency services and external agencies, including contact details;

2) arrangements for internal and external communication;

3) how the organization will maintain or restore its critical asset management activities in the event of a disruption;

4) the provision of resources, and the maintenance of any equipment, facilities or services that could be required during disruptions, incidents or emergency situations;

5) recording of essential information whilst responding to, and managing, incidents and emergencies;

6) the process for returning to normal operations.

The organization shall periodically review, test and, where deemed necessary, revise its plan(s) and/or procedure(s) for incident and emergency preparedness and response and continuity of important asset management activities.

NOTE *It is essential that the organization's contingency plans are reviewed after testing or the occurrence of incidents, emergency situations or disruptions.*

4.3.4.1 General

The organization should assess emergency and incident response needs, plan to meet them, develop procedures and processes to cope with them, test its planned responses, and seek to improve the effectiveness of its responses where necessary.

The organization should, for example, consider potential emergencies arising from:

- significant failure of critical assets resulting in the loss of service or supply to customers or a hazardous condition arising;
- extreme weather conditions, e.g. strong winds, floods, heavy snowfall, lightning strikes;
- unplanned release of hazardous liquids or gases;
- explosion or fire;
- loss of power supply or control systems;
- a combination of events or risks which may result in an emergency situation.

Many organizations will find linkage to the risk assessment process and use of risk identification activities useful in determining which incidents and emergencies to consider.

The organization should develop, identify and provide appropriate emergency equipment, and regularly inspect and preferably test its availability and performance.

Contingency plans (see **4.3.4.2**) should address both the immediate consequences of incidents and, where appropriate, the steps up to, and including, the re-establishment of stable and secure supply/service to customers.

Practice drills should aim to test the effectiveness of the most critical parts of the emergency plan(s) and to test the completeness of the emergency planning process. While desktop exercises can be useful during the planning process, practice drills should be as realistic as possible to be effective. This can require full-scale incident simulations to be conducted. Where appropriate and practicable, the participation of external emergency services in practice drills should be encouraged.

The results of emergencies, incidents and practice drills should be evaluated, and changes that are identified as being necessary should be implemented.

Contingency plans should be regularly reviewed by the organization, at a frequency determined by the organization, to ensure that they are current, i.e. effectively address the *current* risks to the organization.

Further guidance on the establishment of business continuity management can be found in BS 25999-1.

4.3.4.2 Contingency plan(s)

The contingency plan(s) should outline the actions to be taken when specified emergency situations arise, and should include the following:

- identification of potential incidents and emergencies and combinations of incidents and emergencies;
- identification of the individual to take charge during the emergency;
- details of actions to be taken by personnel during an emergency, including those actions to be taken by external personnel;
- responsibility, authority and duties of personnel with specific roles during the emergency;
- provision for safety and status briefings for personnel;
- provision of welfare support and relief for personnel likely to be engaged for prolonged periods dealing with the emergency;
- evacuation procedures;
- identification and location of any hazardous materials, and emergency action required;
- interface with external emergency services;
- communication with statutory bodies, neighbours and the public;
- protection of vital records and equipment;
- availability of necessary information during the emergency, e.g. plant layout drawings, hazardous material data, procedures, work instructions and contact telephone numbers. Consideration should be given to assuring access to information when normal methods of information storage and retrieval and normal methods of communication may not be fully functional.

The involvement of external agencies in emergency planning and response should be clearly documented. Where appropriate, these agencies should be advised as to the possible circumstances of their involvement and provided with such information as they require in facilitating their involvement in response activities. Consideration should also be given to including external agencies either as participants or independent observers during emergency exercises.

4.3.4.3 Emergency equipment and resources

Emergency equipment and resource needs should be identified, and equipment should be provided in adequate quantity. The location and access arrangements for such emergency equipment should be documented and communicated. The location of the equipment and resources should take account of the nature of the potential risk such that access to the equipment and resources will not be compromised should any incident or emergency occur.

Equipment should be inspected and preferably tested at specified intervals for continuing availability and operability.

Examples include the following items:

- alarm systems;
- fault finding equipment;
- tools;
- critical spares;
- communication systems (including call centres resources where appropriate);
- means of transport (e.g. all-terrain vehicles), obstacle removing equipment (e.g. chainsaws, cutting equipment, cranes and hoists), protective clothing;
- adequate levels of competent staff available to mobilize to required schedule;
- information, e.g. plans, procedures, drawings, maps, contact numbers;
- emergency lighting and power;
- fire-fighting equipment, flood recovery equipment and first aid equipment.

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4.4 Asset management enablers and controls

4.4.1 Structure, authority and responsibilities

The organization shall establish and maintain an organizational structure of roles, responsibilities and authorities, consistent with the achievement of its asset management policy, strategy, objectives and plans.

These roles, responsibilities and authorities shall be defined, documented and communicated to the relevant individuals.

***NOTE** There is no need to establish a separate organizational structure provided the organization's structure is consistent with achieving the requirements set out in **Clause 4**.*

Top management shall provide evidence of its commitment to the development and implementation of the asset management system and the continuous improvement of its effectiveness by:

a) appointing a member of top management who, irrespective of other responsibilities, shall be responsible for the overall design, maintenance, documentation, review and improvement of the organization's asset management system;

b) appointing member(s) of management whose responsibility is to ensure that the assets and assets systems deliver the requirements of the asset management policy, strategy, objectives and plans and who have the authority to achieve this;

c) identifying and monitoring the requirements and expectations of the organization's stakeholders and taking corresponding and timely action, to the extent that these have implications for the organization's management of its assets;

d) ensuring that the asset management policy and strategy are consistent with the organizational strategic plan;

e) considering the adverse impact that the asset management policy, asset management strategy, asset management objectives and asset management plan(s) might have on other aspects of the organization. Conversely, considering whether plans generated from other parts of the organization might have an adverse affect on asset management;

f) ensuring the viability of the asset management policy, asset management strategy, asset management objectives and asset management plan(s);

g) ensuring asset-related risks are identified, assessed and controlled, and are included in the organization's overall risk management framework;

h) ensuring the availability of sufficient resources;

i) communicating to all relevant stakeholders the importance of complying with the requirements of the asset management system in order to achieve its organizational strategic plan.

Organizations seeking to implement the requirements of PAS 55-1 on structure, authority and responsibilities, should consider the recommendations and guidance provided below.

a) The successful implementation of asset management requires the commitment of top management. Top management should assign clear responsibilities for the management of asset systems including appropriate accountability for their performance (this may be financial and non-financial) and responsibility for investments/expenditure. Those individuals placed in such positions are sometimes referred to as Asset Managers. Top management should ensure that those with such responsibilities have accepted them and have adequate authority to carry them out effectively. Top management should also ensure that those who are given responsibilities are competent, have adequate resources to discharge their duties and the operational freedom to optimize the cost/effectiveness of these resources in line with the asset management policy, strategy and objectives.

b) The responsibilities and authorities of all persons who perform duties that are part of the asset management system should be defined. Such definitions should, among others, be developed for the following people:

- top management;
- asset managers;
- engineers, designers and technical specialists;
- process operators;
- maintenance personnel;
- inspectors;
- contractors;

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- those responsible for asset management training and facilitation of the asset management processes and techniques.

c) Asset management responsibilities and authorities should be documented in a form appropriate to the organization. This can take one or more of the following forms, or an alternative of the organization's choosing (see **4.4.5**):
   - working procedures and task descriptions;
   - job descriptions;
   - induction training package (see **4.4.3**).

   If the organization chooses to issue written job descriptions covering other aspects of employees' roles and responsibilities, then asset management responsibilities should be incorporated into those job descriptions.

d) The organizational structure of roles, responsibilities and authorities plays a significant part in the successful implementation of asset management. An organizational structure that creates compartmentalized functions, responsibilities and performance measures should be avoided. Key requirements of asset management are a life cycle approach and optimization, and these are difficult to achieve when activities are considered in isolation. For example, whole life cost cannot be optimized if only project expenditure is considered without considering the subsequent performance/income and asset care/maintenance implications. Similarly, operating costs cannot be optimized without considering the effect on productivity and risk.

   Top management should endeavour to create an organizational structure of roles, responsibilities and authorities that facilitates the visibility and comparison of asset/product/service related performance or income with the associated effort and expenditure. There are benefits and disadvantages to any given structure of roles, responsibilities and authorities. The nature of the organization's business, and indeed its culture, will affect the choice of structure to be adopted. For example, some organizations have achieved this through the creation of profit/investment centres and others through activity based costing, combined with the allocation of apportioned/estimated revenues and inter-departmental service level agreements.

   Such arrangements should provide for:
   - readily identifying the value of capital and operating related expenditure and the life cycle (or long-term) impact of any changes in expenditure;
   - accountability for asset performance and the associated expenditure;
   - the avoidance of conflicting departmental performance measures where such measures could result in the gain for one department being to the overall detriment of the organization;
   - the avoidance of reliance upon annual budgets/funding cycles, which may obstruct the adoption of a life cycle approach;
   - motivating the whole team to be continually looking for ways to optimize performance, expenditure and levels of retained risk;
   - the responsibility and authority for readily implementing changes that would be beneficial for the organization.

e) Organizational structures should be clearly communicated to all relevant employees, via an organization chart or other means, and kept updated.

f) In addition to assigning responsibility for ensuring that the assets and asset systems deliver the required outcomes, top management should assign responsibility for the effective management of the organization's asset management system (processes). It is unlikely that the assets will perform satisfactorily over time unless the asset management system is operating effectively.

g) Top management should identify the requirements and expectations of all of the organization's stakeholders. The employment of techniques, such as stakeholder needs analysis, employee/customer surveys, suggestion boxes, discussion forums and demand management should be considered (see **4.4.4**).

h) Top management is normally best placed to ensure that the asset management, policy and strategy are consistent with the organizational strategic plan and to identify where poor asset performance might jeopardize the achievement of the organizational strategic plan.

i) Top management should ensure that adequate resources are available for establishing and maintaining the asset management system, including equipment, human resources, expertise and training. Resources can be considered adequate if they are sufficient to deliver asset management plan(s) and activities, including performance measurement and monitoring. For organizations with established asset management systems, the adequacy of resources can be at least partially evaluated by comparing the planned achievement of asset management objectives with actual results. Consideration should also be given to whether the resources provided were excessive.

j) **4.3.3.1 (g)** provides guidance on, and examples of, the potential adverse impact that asset management plan(s) might have on other parts of the organization and conversely, the impact that plans generated in other parts of the organization might have on asset management.

k) Top management should communicate to the organization and to relevant third parties the importance of meeting its asset management requirements in order to achieve its organizational strategic plan (see **4.4.4**).

l) Ultimate responsibility for the identification, assessment and management of risks rests with top management. It is therefore essential that they are satisfied with the associated procedures and activities, and that all concerned are aware of, and have accounted for, these risks. The organization should have an organizational risk register and it is essential that significant asset related risks are recorded in this register (see **4.4.7**).

m) Top management should ensure the viability of the asset management strategy, objectives, targets and plans. The act of producing them is no guarantee that they are achievable. Therefore an assessment of the organization's asset management strategy, objectives, targets and plans (maintenance and capital works) should be carried out, at intervals determined to be appropriate by top management (see **4.6.5** and **4.7**).

4.4.2 Outsourcing of asset management activities

> Where an organization chooses to outsource any aspect of asset management that affects conformity with the requirements of **Clause 4**, the organization shall ensure control over such aspects. The organization shall determine and document how these parts will be controlled and integrated into the organizations' asset management system. The organization shall also identify and document:
>
> a) the processes and activities that are to be outsourced (including the scope and boundaries of the outsourced processes and activities and their interfaces with the organization's own processes and activities);
>
> b) the processes and scope for the sharing of knowledge and information between the organization and the contracted service provider(s);
>
> c) authorities and responsibilities within the organization for managing the outsourced processes and activities.

Many asset management organizations have developed contracting strategies and supply chain alliances to provide them with asset management services. Business relationship models, such as engineering, procurement and construction (EPC), public-private partnerships (PPP), private finance initiatives (PFI) and build-operate-transfer contracts (BOT), have emerged to enable combinations of organizations to deliver complex asset investments and asset management programmes. Such contracts can result in an

organization effectively outsourcing most of its asset management activities from asset management strategies, objectives and plans down to the activities in the asset management plan(s).

A requirement of PAS 55-1 is to ensure that risk, value and sustainability are managed across contractual boundaries, and that the asset owner and asset manager retain appropriate controls across contractual boundaries. This is particularly relevant where services are provided by third party organizations that do not have a long-term stake in the success of the organization. For this reason, PAS 55-1 requires demonstrable governance with clearly established authorities and responsibilities. Many organizations achieve this by forming alliance relationships with their suppliers, whereby rewards and penalties are aligned to the performance of the assets or asset systems and to the achievement of the asset management objectives.

Where an organization chooses to outsource any of the requirements (or part of the requirements) set out in PAS 55-1, the organization is required to ensure control over such processes. For example, a contracted service provider may be required to develop asset management plan(s) and also to implement them. In such an instance the organization should ensure that the asset management plan(s) are consistent with its own asset management policy, strategy, objectives and targets. Furthermore, it should also have to ensure that all of the other requirements of PAS 55-1 are complied with, e.g. life cycle and sustainability considerations, controlled implementation of the asset management plan(s), performance monitoring and continual improvement.

When determining the proposed extent of outsourcing, the organization should ensure that the relevant aspects and requirements of PAS 55-1 are clearly identified in contract specifications and that they are understood in the tendering process. The roles, authority and responsibilities of all parties in the contract should be clearly stated and agreed. The outsourcing of asset management responsibilities should be defined in measurable terms.

An organization may establish that the terms and conditions of existing contract arrangements do not adequately address aspects of PAS 55-1. The assessment of risk arising from such situations, and the steps required to control or mitigate such risks, should be handled in accordance with **4.4.7**.

4.4.3 Training, awareness and competence

The organization shall ensure that any person(s) under its direct control undertaking asset management related activities has an appropriate level of competence in terms of education, training or experience.

NOTE *Levels of appropriate asset management competence can be ascertained through the use of a competency requirements framework (see Bibliography for examples of relevant competency requirements frameworks).*

Where asset management activities are outsourced, the organization shall ensure that contracted service providers have arrangements in place to ascertain and demonstrate that their staff are competent.

The organization shall develop plans for the human resources required to develop and implement its asset management system. The organization shall identify the competency requirements for these human resources and plan the training necessary for them to achieve these competencies. It shall arrange for provision of this training and retain associated records.

The organization shall establish, implement and maintain process(es) and/or procedure(s) to make persons working under its control aware of:

a) the asset management related risks associated with their work activities and the asset management benefits of personal performance;
b) their roles and responsibilities and the importance in complying with the asset management policy, process(es) and/or procedure(s) and plan(s);
c) the potential consequences of departure from specified asset management process(es) and/or procedure(s).

4.4.3.1 General

Training and competence requirements, plans and resources should be matched to the asset management plan(s), ensuring that the necessary human resources are in place to meet the short, medium and long-term commitments of the plan. In addition, organizations should consider the following recommendations and guidance:

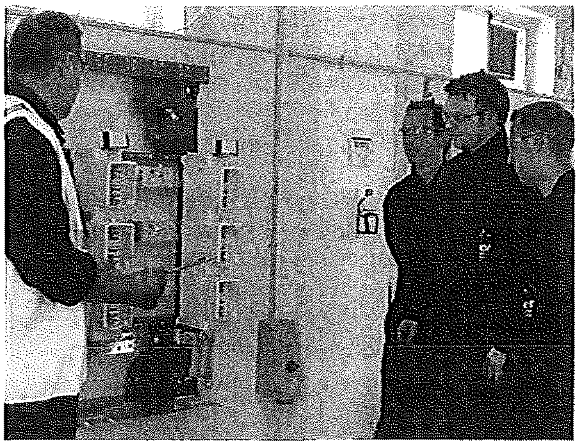
a) Organizations should have effective procedures for ensuring the competence of employees to carry out their designated asset management functions.

b) The following elements should be included in the asset management training, awareness and competence process:
   - a systematic identification of the asset management awareness and competencies required at each level and function within the organization;
   - arrangements to identify and remedy any shortfalls between the employee's current and required levels of asset management awareness and competency;
   - provision of any training identified as being necessary, in a timely and systematic manner;
   - assessment of employees to ensure that they have acquired, and that they maintain, the asset management knowledge and competency required;
   - maintenance of appropriate records of employees' training and competency.

c) An asset management awareness and training programme (which may form part of a wider programme of training) should be established and maintained to address the following areas:
   - provide employees with an understanding of the organization's asset management arrangements and the employees' specific roles and responsibilities in these arrangements;
   - ensure the systematic induction of employees as they enter the organization, transfer between business units or sites, or change jobs or roles;
   - provide training in local asset management arrangements and risks, precautions to be taken and procedures to be followed (this training should be provided before work commences);
   - provide specific in-house or external training for employees with specific asset management roles, e.g. risk management, life cycle costing, optimization, reliability engineering, maintenance, inspection, condition monitoring, root cause analysis;
   - describe the roles and responsibilities (including corporate and individual legal responsibilities) of top management for ensuring that the asset management system functions to control risks and reduce potential losses to the organization to tolerable levels;
   - ensure that training and awareness programmes are provided for contractors and temporary workers engaged in the organization's asset management activities;
   - ensure the systematic provision of ongoing update and refresher training for all employees in the organization.

d) Relevant to their role, the organization should establish, implement and maintain process(es) and/or procedure(s) to make persons working under its control aware of:
   - asset management related risk consequences (actual or potential) of their work activities, their behaviour, and the asset management benefits of improved personal performance;
   - their roles and responsibilities and importance in achieving conformity to the asset management policy and process(es) and/or procedure(s) and to the requirements of the asset management system, including emergency preparedness and response and contingency planning requirements (see **4.3.4**) and impact on other management processes;
   - the potential consequences of departure from specified process(es) and/or procedure(s).

e) Training procedures should take into account differing levels of:
   - authority;
   - responsibility;
   - ability;
   - language skills and literacy;
   - risk.

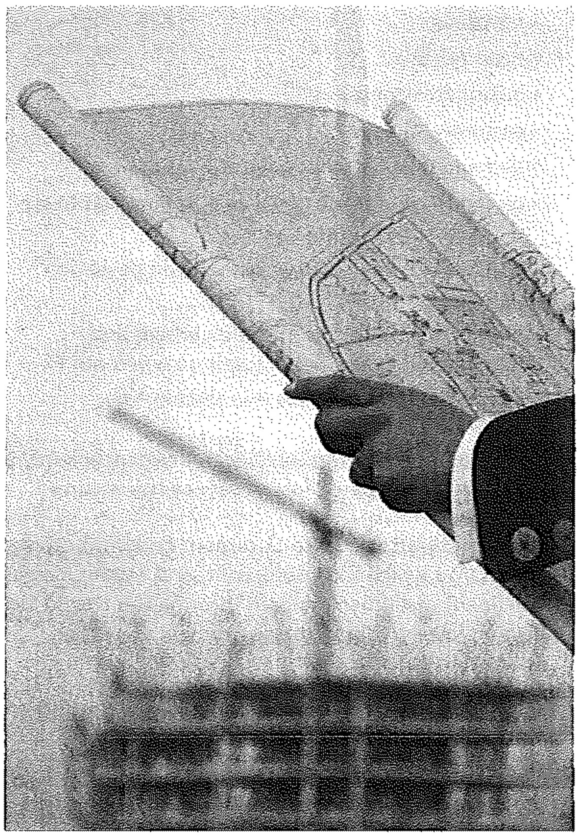


f) The effectiveness of training and the resulting level of competency should be evaluated. This can involve assessment as part of the training exercise, and/or appropriate field checks to establish whether competency has been attained, or to monitor the medium-term impact of training delivered.

g) The organization should consult and seek feedback regarding any training, awareness and competence shortfalls from employees and contractors to facilitate ongoing improvements and ensure future requirements are identified and met.

4.4.3.2 Competencies in asset management

Activities and processes within the asset management system require the integration and alignment of many aspects of a business, and depend upon a wide variety of individual and corporate competences. An organization that is heavily dependent upon the performance of physical assets should actively monitor, develop and maintain an appropriate balance of these competencies. In particular, the asset management system should provide for adequate skills and competencies in the performance of the following key activities and processes (see Bibliography for examples of relevant competency requirements frameworks).



4.4.4 Communication, participation and consultation

> The organization shall ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers.
>
> The organization shall ensure consultation with stakeholders that is relevant and appropriate to their involvement in:
>
> a) the development of the asset management strategy, objectives and plan(s);
>
> b) the development of functional policies, engineering standards, process(es) and/or procedure(s);
>
> c) risk assessments and determination of controls;
>
> d) incident investigation;
>
> e) the continual improvement of the asset management system.

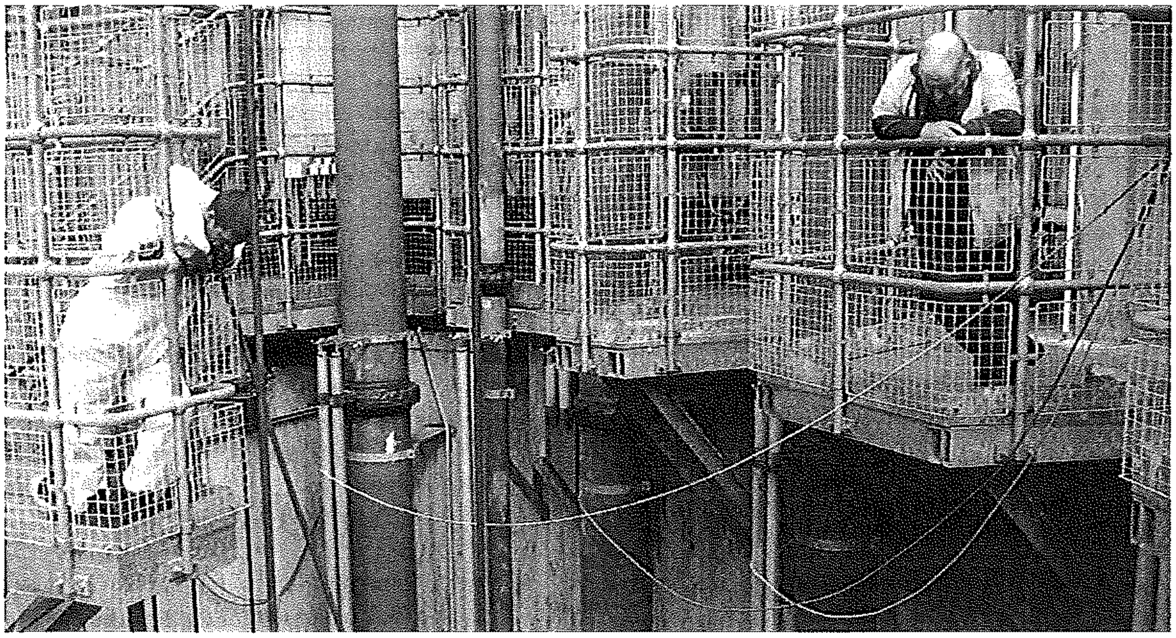
The organization, through the processes of communication and consultation, should encourage participation in good asset management and support for its asset management, policy strategy and objectives from those affected by its activities or interested in its asset management system.

Communication is not just about the distribution of information; it should ensure that asset management information is provided, received and understood across the organization. Effective communication is a two-way process, both top-down and bottom-up.

Consultation is the process by which management and other persons, or their representatives, jointly consider and discuss issues of mutual concern. It involves seeking acceptable solutions to problems through the general exchange of views and information.

Examples of those who may be interested in, or affected by, an organization's asset management system include customers, organization owners or investors, employees at all levels of the organization, suppliers and contracted service providers, local society, emergency services, insurers, government or regulatory bodies, external inspectors or auditors.

The appropriate use of consultation and participation can be a powerful aid to the development of the workforce, promoting teamwork, individual and collective responsibility and accountability, and helping to create an organizational culture of continuous improvement.



Examples of good practice mechanisms in consultation and communication with employees and contractors include:

- inclusion of asset management issues in:
  - formal management and employee meetings and consultations;
  - briefings for employees contractors and other interested parties.
- initiatives to encourage employee asset management consultations, review and improvement activities, including the development and/or modification of:
  - asset management plan(s);
  - functional policies;
  - standards;
  - process(es) and/or procedure(s).
- employee involvement in risk identification, assessment and control;
- employee involvement in incident investigation;
- formal and informal channels for feedback to management, through mechanisms including suggestion boxes, telephone "hotlines", management visits;
- use of organizational intranet systems for timely dissemination of pertinent information;
- knowledge management systems;
- notice boards containing asset management performance data and other pertinent asset management information;
- asset management newsletter.

Where appropriate, organizations should effectively and proactively communicate with their customers. Examples of good practice in consultation and communication with customers include:

- newsletters;
- press releases;
- informative websites;
- customer surveys;
- demand management advice to customers;
- research to establish customers' willingness to pay for a specified level of service;
- customer charters and published compensation schemes;
- provision of public information where asset management activities are being carried out in publicly-accessible areas, e.g. road works, construction sites;
- customer call centres, messages, announcements, etc., in particular when a loss of service has occurred.

The organization should document and promote the manner in which it consults with, and communicates, pertinent asset management information to and from its employees, contractors, customers and other interested parties.