Asset management — Overview, principles and terminology

Gestion d’actifs — Vue d’ensemble, les principes et la terminologie

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 55000 was prepared by Project Committee ISO/TC 251, Asset Management.
0 Introduction

0.1 Purpose

Asset management involves a disciplined approach which enables an organization to maximize value (or minimize liabilities) from the portfolio of assets for which it has a responsibility in delivering its strategic objectives. This includes determination of appropriate assets to create or acquire in the first place, how best to utilize and support them, and the adoption of optimal renewal or disposal actions, along with the ongoing management of any residual liabilities.

The purpose of this International Standard is to provide an overview of the benefits, principles, concepts and terminology relating to assets, asset management and asset management systems.

0.2 Target audience

This International Standard is primarily intended for use variously by:

a) those involved in setting asset management policy and developing long term asset management plans;

b) those who require an introduction to management systems for the management of assets;

c) those involved in the development, implementation, operation and continual improvement of management systems for an organization’s assets;

d) those involved in delivering asset management activities and related service providers;

e) those seeking to declare, confirm, assess or seek certification of conformity to this International Standard;

f) internal and external parties, including certification bodies, to assess the organization’s ability to meet legal, regulatory and contractual requirements and the organization’s own requirements.

Further information is provided in:

ISO 55001 Asset management – Management systems – Requirements

ISO 55002 Asset management – Management systems – Guidelines on the application of ISO 55001

NOTE The term ‘enterprise asset management system’ is sometimes used to refer to certain software systems for asset information and work management. This is not the meaning used for an “asset management system” within these International Standards on asset management, although such software can provide a valuable supportive capability within an overall management system. The term ‘asset management system’ is used in these standards to refer to a ‘management system’ consisting of a set of interrelated or interacting elements of an organization to establish asset management policies and objectives, and processes to achieve those objectives.

0.3 Benefits

Organizations utilize ‘assets’ in meeting their stakeholder needs. As the demands on organizations increase for delivering higher levels of output or service performance at lower cost, there is a greater need to understand the discipline of asset management. Whether an organization is in the public or private sector, profit making or not for profit, top management find themselves more frequently challenged with questions like:

— What asset related risks are we carrying and how does that retained risk profile change with time over the period for which we are responsible for the assets?

— Why do we need to invest this much money and resource into our asset base and what are the consequences of reducing that, both now and in the future?

— Are there benefits associated with outsourcing some or all of our activities and how does that change our risk and cost profiles?
Do we have the capabilities, competences and information to make sound decisions on asset investments and implement effectively the actions arising from those decisions?

As the discipline of asset management has evolved, those organizations that are more mature in their asset management approaches are both more comfortable with being able to answer these kind of questions but are also able to demonstrate improved levels of performance, lower costs, more productive workforces and greater levels of credibility in the face of customers, regulators and investors. The published benefits of asset management applications are increasing all of the time.

The discipline of asset management is broad and touches not only the whole of an organization but also many competence areas within it. Many organizations have captured a core of their asset management activities within a set of processes and procedures referred to as their "asset management system". This collection of processes is a core mechanism for managing asset related risks and ensuring that decisions are made in a consistent manner. The benefits of an asset management system include assurance that activities that have the potential to impact on asset related risk, performance and cost are adequately described, communicated and controlled. The processes are essential to ensuring that assets are managed appropriately in delivering the organization’s objectives; additionally, they provide a framework for the wider elements of asset management, such as culture and communication, to flourish and grow from a structured foundation.

The ISO 5500x set of International Standards has captured good asset management system practices from a multitude of industries across the globe, and has defined what needs to be done (as a minimum) to ensure that an organization has an effective asset management system. The key benefit of this set of International Standards is that they capture a base level of ‘requirements’ for an asset management system that allows the organization itself to determine how it should implement these base requirements in a way that best meets its organizational objectives and stakeholder needs.

0.4 Structure

The scope of this International Standard is given in clause 1.

Asset management involves a broad range of principles, concepts and processes that help translate organizational objectives into decisions and actions on assets to achieve these. Assets are seen as entities that hold potential or actual value; and asset management enables realization of this value. Figure 1 below shows the key concepts covered in clause 2 of this International Standard.
ISO 55001 distinguishes requirements that relate to asset management (i.e. the planning and delivery of activities undertaken on assets to derive value) from those that apply to the "asset management system" needed to coordinate and enable asset management activities. The key concepts have been grouped in this International Standard under ‘Benefits of asset management’ (see clause 2.1), ‘Organizational context’ (see 2.2), ‘Assets’ (see 2.3) and ‘Asset management’ (see 2.4), while the management system enablers and capability concepts are introduced under ‘Asset management system’ (see 2.5). It should be noted that an overall “asset management system” comprises of all the elements shown in figure 1.

Asset management is the core route to deriving value from assets (the central part of figure 1) and this is supported, controlled and sustained by a management system that comprises a number of ‘enablers’ and ‘capabilities’ (the top and bottom sections in figure 1).

The asset management function needs to integrate with other organizational functions such as financial management, human resources management, etc. and its other management systems (see 2.5.5). An organization can find it useful to develop an integrated management system, as appropriate for its needs, that demonstrates compliance with a number of management system standards such as ISO 9001, ISO 14001, ISO 55001, etc. The ISO 5500x set of International Standards can be used in combination with any relevant sector or asset type-specific asset management standards and technical specifications.

Specific terms on asset management that apply to all of the ISO 5500x International Standards are defined in clause 3; other terms with common dictionary definitions that are also applicable are listed in Annex A.

Annex B provides a mapping between the ‘concepts’ covered in ISO 55000 and the ‘requirements’ in ISO 55001.
Asset management — Overview, principles and terminology

1 Scope

This International Standard provides an overview of the principles, concepts and terminology relating to assets, asset management and asset management systems, and the expected benefits from adopting these approaches.

This International Standard can be applied to the management of all types of assets.

NOTE 1 This International Standard is particularly intended to be applied to the management of physical assets but this does not limit application of the principles to other asset types.

This International Standard is applicable to all types and sizes of organization.

This International Standard does not specify financial, accounting or technical requirements for the management of specific asset types.

This International Standard is not intended to be used on its own for certification, regulatory, or contractual purposes (except for the included terms and definitions in conjunction with ISO 55001).

2 Overview and principles

2.1 Benefits realization

Asset management enables realization of value from assets in the delivery of organizational objectives. What constitutes value will depend on the organization’s priorities and the expectations of its stakeholders. An asset management system seeks to achieve the best combined outcome of cost, risk and performance consistent with the asset management policy and the delivery of performance as aligned to the organizational objectives. A clear understanding of what constitutes value, and methods of determining value-for-money, are necessary for decisions that involve trade-offs between short-term and long-term effects, and for measuring benefits.

Value driven asset management decisions represent the optimal combination of costs, risks, performance (or service losses) and other effects on an organization’s business goals (such as sustainability or damage to reputation) over the life of its assets. All these aspects are inter-related and, as a result, changing one aspect (such as reducing costs) will impact on all the others. The resulting benefits are derived from the improvement in combined effects and can involve, for example, additional costs in one asset life stage, and lower risks, better performance or deferment of expenditures in another asset life stage.

Examples of value realization achievable through asset management include:

a) **Improved business performance** – enhanced asset performance can result in improved services, outputs and return-on-investment. Organizations report improvements of 5, 10, 20 or 40% in their overall performance and service levels as a result of better asset management;

b) **Improved operational efficiency** – organizations can reduce costs and improve asset performance without sacrificing long term performance. Sustained reductions in the total cost of operation across the asset life can often be found to be in the 20-40% range;

c) **Reduced risk** – increased awareness, transparency and consistency in the identification, quantification, reporting and control of asset related risks; thereby reducing financial losses, improving safety and minimizing environmental impact. This could lead to reduced insurance premiums in some cases. Asset
reliability, system availability and system integrity improvements are reported from many industry sectors as a result of improved risk-based asset management;

d) **Assurance of compliance** – through on-going monitoring and independent audits, assurance can be obtained on the compliance with legal, regulatory and contractual requirements and also adherence to standards, policies and processes relevant to asset management activities;

e) **Improved customer satisfaction** – through consistent and repeatable practices and processes delivered by asset management through the asset management system customer service levels can be guaranteed and raised. The result of the increased service level attainment leads to stakeholder and customer peace of mind. This is particularly important for organizations where the service provided to customers depends on the performance of assets;

f) **Improved stakeholder confidence** – stakeholder confidence can be achieved through having a reliable and predictable operating state. Predictability in an environment of change is often very difficult to achieve unless there are good foundations facilitated through the asset management system. The combination of risk, cost and performance will be directly proportional to the stakeholder expectations which can change based on higher confidence levels over time;

g) **Improved sustainability** – evident and appropriate handling of short term versus long term effects, expenditures, and performance, improves long term sustainability of operations. Improved asset management can reduce environmental impact and provide improved social outcomes. Legislative and regulatory arrangements often require organizations to meet and demonstrate sustainability outcomes. Assets can have a major environmental impact but can also provide significant social benefit to communities. Many government and private organizations at the international, national, state, and local levels are setting sustainability goals for themselves. These issues are considered in many boardrooms, where it is already well appreciated that assets provide major opportunities for reducing environmental impact and can provide improved social outcomes when they are managed effectively;

h) **Improved organization culture** – establishing cross-functional teamwork, with a sense of common purpose and ownership can result in greater innovation, motivation and employee satisfaction. An asset management system, like other management systems, enables all the processes, activities and resources to be harnessed, focused and channelled to support and drive a common purpose in line with the organizational objectives and values.

### 2.2 Organizational context

The nature and purpose of an organization, the industry sector and the internal and external environment, within which it operates, have a strong bearing on the type of assets that the organization requires and the asset management capabilities that it needs to develop in delivering its business objectives. These influencing factors need to be considered in determining the objectives and outcomes of asset management and the asset management system.

The organization should determine and understand the following influencing factors as a minimum:

a) its vision, mission and objectives;

b) its stakeholders (both internal and external), including its customers, and their expectations;

c) the legal, regulatory and other absolute requirements that it needs to comply with;

d) the political, economic, social, technical and environmental factors which impact on its activities;

e) the constraints (for example, limitations on financial, human and other logistical resources) within which it has to operate;

f) its policy and decision making criteria (for example, risk evaluation, judgment of priorities, balancing trade-offs between short-term and long-term effects);
g) its approach for balancing short term business needs and planning cycles with long term asset life management.

An organizational strategic plan generally addresses the above influences and sets clear and long term objectives for the organization and the strategic approach for achieving these.

Asset management objectives can be derived from the organizational objectives, by taking account of the internal and external influences that impact on asset management activities.

2.3 Assets

2.3.1 Assets, asset systems and asset portfolio

An "asset" is defined as something that has potential or actual value to an organization. Value, however, will mean different things to different people and different organizations. Value can be tangible or intangible, financial or non-financial.

An "asset system" refers to a set of interconnected assets (of one or multiple asset types) working together, and can be regarded as an asset in itself. Where assets act in a system, additional value can be derived from the asset system beyond that derived from the individual assets on their own (for example, a bridge on its own versus a bridge in a road system; or a software license versus a software license in an I.T. system).

Grouping assets into an "asset portfolio" enables a holistic approach to be used in the delivery of organizational objectives. An asset portfolio can include multiple asset types and asset systems. In the context of this International Standard the use of the term "asset portfolio" is defined as all the assets under the organization's control and does not imply ownership.

2.3.2 Asset types

Asset types are groupings of assets having common characteristics that distinguish them as a group or class for asset management purposes.

Examples of asset types include but are not limited to

- physical assets
- information assets
- financial assets
- intangible assets
- critical assets
- enabling assets
- linear assets
- information technology (I.T.) assets
- infrastructure assets
- moveable assets
- human assets
2.3.3 Asset life, asset life cycle and asset life stages

"Asset life" is defined as the period from an asset's conception to its end of life. The asset life is defined as having three basic segments which are: concept; existence; and end of life.

"Asset life stages" are the phases an asset passes through during its life. The definitions applied to the asset life stages will usually differ between organizations. In addition, the three basic segments can be broken down by the organization into more discreet stages, and also be assigned its own segmental definitions. There are a number of standards and other publications that address the breakdown and the merits for doing so.

At an organizational level the collective term used to describe the management of assets, and not a specific asset, is "asset life cycle". The term does not imply a circular path for individual assets and needs to be adopted as an organizational management term. The asset life cycle is made up of asset life stages.

Understanding the different terms can enable an organization to manage its assets in the most appropriate manner. Asset management focuses on asset value realization; appropriate techniques, processes and methodologies should be utilized to deliver this need.

An asset holds continuing value potential to one or more organizations over its life. Asset life does not necessarily coincide with the period over which any one organization holds responsibility for the asset. The role of asset management is to maximize value from assets across each of the asset life stages that fall within (or in some instances beyond) the "responsibility period" of the organization.

The "responsibility period" is the period of time over which an organization has accountability for an asset and can be within one or many of the assets life stages.

The "functional requirement" is a term used to describe the need an organization has for an asset. This can be fulfilled by an existing asset (brought into the organization), or drive the conception of a new asset. The functional requirement can exist for longer than the asset life; in such cases multiple assets can be used to fulfil the functional requirement. In cases where the functional requirement is less than the asset life, then the asset may be utilized by another organization at an appropriate stage of that organization's life cycle.

2.4 Asset management

2.4.1 General

"Asset management" is defined as the coordinated activities of an organization to realize value from assets. Realization of value usually involves an optimization of costs, risks, opportunities and performance benefits.

Asset management can only be effective if the organizational objectives are considered, understood and established within the operating context of the organization. It is only in combination that value realization and sustained operation can be established.

Asset management is multi-dimensional; it allows an organization to examine its assets at different hierarchical levels (individual "asset" units, integrated "asset systems" or the whole "asset portfolio") and apply different approaches over the asset life cycle stages. It optimizes the total picture of what is done to assets in relation to what is achieved from them (i.e. value, often on different timescales).

A key feature of asset management is the alignment of activities undertaken on assets to the organizational strategic objectives. This is achieved through:

a) the establishment of a balanced set of asset management objectives aligned with the organizational objectives;

b) the development of asset management plans for achieving asset management objectives while optimizing costs, risks and performance over short and long timeframes in the face of competing stakeholder expectations;

c) the efficient and effective delivery of the asset management plans and the control of asset related risks;
d) the measurement of asset and asset management performance on an ongoing basis and using this feedback to achieve continual improvement.

The above alignment is enabled through the establishment of an asset management policy by top management and the setting down of clear asset management principles that are adhered to in the planning and delivery of all asset management activities. This enables managers to have a clear view of what is actually happening, the impact of their decisions and the justification for resources. It ensures decisions are made within the context of the long term strategic approach of the organization.

Assets generally cost money, are managed by people and sometimes have networked control systems. It is difficult to completely separate asset management from financial, human resources and information management, and their supporting information technology (I.T.) systems.

A cross-disciplinary, holistic and whole life view of asset management is possible and can yield significant tangible, sustained benefits compared to the ‘silo’ operation of individual functional departments.

### 2.4.2 Asset management principles

Asset management is founded on a set of principles. The absence of any one principle can result in a reduction in the value realized from assets. An organization may choose to mandate these principles through its asset management policy.

The asset management principles are:

a) **Assets exist to provide value to the organization and its stakeholders**

Asset management does not focus on the asset itself, but on the value the asset can provide to the organization. Value is defined by the organization and its stakeholders, and can be both financial and non-financial in nature.

The value to be realized from its assets is determined by the organization’s objectives.

The principle implies that the determination of the value to be realized requires:

- a clear statement of what the organization is to achieve, over what time period, and with what assurance to its stakeholders

- the establishment of decision-making processes and criteria for selecting the portfolio of assets that the organization needs to hold, and the performance that the assets need to deliver, to meet the organization’s requirements.

b) **Asset management turns the organizational strategic intent into decisions and actions on assets to realize their value**

Asset management is based on a sound knowledge of the organization’s internal structures as well as its external influences (including regulatory, political, socio-economic, technological and market forces).

An organization needs to regularly review and consider its requirements and opportunities; both in the short and long term, and objectively weigh those requirements against their impacts.

To assist in successfully achieving the organization’s strategic objectives, asset management decisions taken at the technical, financial and operational levels should all be aligned with those objectives. It is the connection between the organization’s objectives and the asset life cycle activities defined through the long term asset management plan(s) that enables the organization to consistently achieve its strategic intent.

The principle implies that to achieve the strategic intent the organization needs to:

1) put in place risk based, data driven planning and decision-making processes and activities capable of determining from the organizational objectives (and the organization’s risk framework):
what the assets need to achieve, by when, and with what assurance

— the tasks, activities and resources needed to deliver the required asset performance

— the efficient and effective implementation of the identified asset life cycle activities to collectively achieve the organizational objectives;

2) integrate the asset management processes with the other functional areas of the organization, such as finance, human resources, information technology, spares/logistics and operations.

c) **Strong leadership and an engaged workforce are a key determinant of value realization**

Strong leadership and commitment from top management are essential for successfully establishing, operating, and improving asset management within the organization. This is enabled through the development of an asset management policy, setting objectives, making resources available and communicating the importance of asset management to all employees and service providers.

The organization’s ability to recognize, develop, retain and reward its people, are key determinants in the achievement of an organization’s objectives, through the use of its assets. Engaged employees understand the organizational purpose and consistently achieve the organization’s objectives and goals.

The principle implies that the organization should:

— clearly define the responsibilities of top management for the asset management system and cascade this to different levels through an organization of roles, responsibilities and authorities

— ensure that its employees have the right competence to discharge their responsibilities

Employees and service providers should be actively engaged and regularly consulted on significant changes and in identifying opportunities for improvement.

d) **Asset management requires a focus on continual improvement**

The continual improvement of the management of assets provides an organization with the ability to react favourably to the competitive and social pressures it faces and to achieve its organizational objectives on a consistent basis.

The principle implies that the organization’s asset management should:

— establish processes for monitoring and measurement of asset and asset management performance

— establish processes for evaluating actual performance against defined objectives; take preventive and corrective actions to address deficiencies; and proactively identify opportunities for improvement

— provide people with the right training and encourage them to aspire for continual improvement

— recognize, acknowledge and reward improvements.

2.4.3 **Asset management policy**

The asset management policy describes the corporate intent, principles and mandated requirements for the management of assets within the organization. The asset management policy affirms a commitment by top management to the implementation of asset management within the organization, consistent with its strategic needs, and provides a framework for setting objectives and developing plans.
The authorities and responsibilities for decision making in relation to the management of assets and the establishment, operation and continual improvement of a formal asset management system may also be documented as part of the asset management policy.

The policy needs to be communicated to all employees, key service providers, and relevant external stakeholders, so that everyone understands and adopts the organization’s intent and approach for asset management.

2.4.4 Asset management objectives and planning

2.4.4.1 Asset management objectives

Asset management objectives support the achievement of the organization’s strategic plan. The asset management objectives translate the strategic intent and organizational objectives into specific objectives to be delivered by assets (see clause 6.2.1 of ISO 55001).

Asset management objectives recognize stakeholder requirements, organizational objectives, risks and opportunities and the available resources and timescales.

Asset management objectives should be defined at levels relevant to an organization’s needs. For example, asset management objectives may be defined for:

- the products and services to be delivered to stakeholders and customers;
- the performance of assets, asset systems and the asset portfolio as a whole;
- the efficiency and effectiveness of asset management activities and plans;
- the maturity of asset management system processes;
- the maturity of the organization and the competence of its people; and
- the quality and adequacy of information to support the asset management system.

A feature of asset management is the connectivity between the organization’s objectives and strategic plan with the asset management objectives. This can be achieved by implementing analytical decision making processes that identify what has to be done and what is worth doing at all the relevant levels, and the cascading of a set of objectives for the portfolio, the asset systems and the assets.

Such an alignment should mean that the reason for asset life stage activities are understood, are able to be documented, while being visibly derived from one or more of the organization's stated objectives. To enable this, the asset management objectives should be both specific and measurable.

2.4.4.2 Strategic approach for decision-making

In order to determine the life cycle activities to be undertaken on assets to achieve the asset management objectives, the organization should establish (see ISO 55001, clause 6.2.2) appropriate arrangements, functional policies, standards, processes and procedures, asset management enablers and resources for:

- the efficient and effective development of asset management plan(s); and
- the implementation of the asset management system and the asset management plan(s).

Such an approach should include consideration of

- the organization’s risk based decision criteria for planning and investment
- the opportunity for non-asset solutions in its asset management plans
- the achievement of a balanced outcome consistent with the organizational objectives, timelines, and any long or short term asset life cycle needs
— the strategic approach and preferred methods to be employed in managing the assets over their lifecycle, and

— an integrated asset management system improvement plan.

The decision criteria should be consistent with and enable the achievement of the intended outcomes of the organizational strategic plan. The criteria need to be discussed with and agreed by all internal and relevant external stakeholders, with a clear view on their implications to risks and opportunities in the short and long-term timeframes.

Applying the decision criteria consistently can ensure that investments of finance, resource and management attention are focused on those areas and assets that should deliver the greatest value.

The strategic approach should stipulate the organization's approach, for example, for demand forecasting, demand management, whole life costing, investment appraisals, asset disposal and replacement criteria, etc.

The decision criteria and the strategic approach should promote transparency in decision-making, resolve conflicting stakeholder expectations, allow asset management plans to be developed on a consistent basis, and ensure the allocation of resources to activities that align with the organizational objectives and priorities.

2.4.4.3 Asset management planning

Asset management plans should be developed to support the achievement of the organization's asset management objectives (see ISO 55001, clause 6.2.2).

Asset management plans should be developed for individual major assets, asset systems and for the asset portfolio as a whole.

The specific content of an asset management plan should be determined by the context of its use and the organizational need for assurance. In general, asset management plans may contain the following:

— identification of the assets and the interfaces to other assets relevant to the plan

— the asset life stage activities and needed resources that, when implemented, should achieve the required performance

— the resultant risks associated with the implementation of the plan

— the responsibilities and associated competencies for the implementation of the asset life stage activities and the related timescales

— the methods for evaluating results following the implementation of asset life cycle activities.

Asset management plans should also be developed for the initial implementation and continual improvement of the organization's asset management system.

2.4.5 Operation

2.4.5.1 Implementation of asset management plans

Asset management plans should define all the asset life stage activities needed to achieve the asset management objectives. The implementation of identified risk control measures should also be integrated with the implementation of asset management plans (see ISO 55001, clause 8.1).

The effective and efficient implementation of the asset life stage activities can be enabled by functional policies, standards, processes and procedures.

Only authorized and competent personnel should be assigned to implement the plans.
The outcome of their operation should be the harvesting of value from the assets used by the organization.

2.4.5.2 Management of change

In responding to changes in the internal and external environment, stakeholder requirements, or for other reasons, an organization could need to introduce changes to its asset management system.

Changes can introduce risks to the achievement of the asset management objectives. Such changes include the introduction of

- new or modified assets
- new technology
- new or modified I.T. systems
- new service providers
- revised standards and procedures, or
- changes in organizational structure.

The risks resulting from changes should be assessed and appropriate risk control measures put in place before implementing the changes (see ISO 55001, clause 8.2).

When implementing the asset management system for the first time or when making major changes to it, formal change management approaches should be adopted that are commensurate with the scale of changes and potential risks.

2.4.5.3 Outsourcing of asset management activities

An organization may choose to outsource some of its asset management activities to external service providers. The level of activities outsourced can vary greatly; however, in every case, the outsourced activities and processes should be considered as part of the organization’s asset management system, as long as the responsibility for managing safety, performance, costs, revenues and risks remains with the parent organization. The organization should exercise control over its outsourced activities, as they can impact the achievement of its asset management objectives.

2.5 Asset management system

2.5.1 General

An asset management system is a set of interrelated and interacting elements (such as business processes and governance activities) to establish policies, objectives, strategies, plans and activities to maximize value (including minimization of costs and risks) from a portfolio of assets and asset systems in the delivery of organizational objectives over a specified period of responsibility.

Asset management involves the coordination of contributions from many parts of an organization and a disciplined approach to create value from the asset portfolio, over the period of responsibility. This requires clear communications and high levels of collaboration and coordination between different departments and functions, good planning and prioritization of activities, and processes for monitoring, evaluation and continual improvement. An asset management system provides the means by which all such contributions are captured and controlled towards a common purpose, the delivery of the organization's objectives.

An asset management system is a framework of control and coordination, containing a number of discrete elements and important relationships. It should be seen as an integrated, cross-functional way of ensuring that all activities are aligned to the delivery of the organization’s objectives and that processes of continual improvement are followed at several levels.
There are three core themes within an asset management system (see figure 2):

a) the (top down) alignment of organizational objectives into asset management policy, objectives, strategic approach, asset management plans and asset life cycle activities;

b) the objectives, planning and continual development of the asset management system itself, including the necessary asset management capabilities (such as resources, processes, competencies and technologies), and

c) (bottom up) continual improvement: monitoring, analysis, evaluation, improvement actions and change management for assets, asset systems, asset life activities and for the asset management system.

There are also three major groups of ‘enablers’ that have a vital, system-wide influence (see the Introduction, figure 1) on the effectiveness of the asset management system:

a) people management: leadership, organization, competencies, motivation, teamwork, and communications;

b) risk management: identification, quantification, control, mitigation and monitoring;

c) information management: asset and asset management data, information and knowledge management.

The criticality and complexity of the assets being managed, and the operational context of the organization should be used to determine the level of detail and the degree of documentation needed for the asset management system. For example, an organization responsible for a portfolio of simple, discrete, assets in a lightly regulated context can have a very simple asset management system; in contrast, an organization that is
responsible for high value, complex, or high risk, assets needs a more sophisticated asset management system, with more elements formally documented and to a higher level of detail. This is why the development of an asset management system and appropriate asset management capabilities should be determined from the organizational context, stated commitments (asset management policy), asset management objectives and desired strategic approach to the management of the assets.

2.5.2 Key elements of an asset management system

2.5.2.1 Organizational strategic plan and organization context

An asset management system is the mechanism for an organization to deliver its objectives in a controlled, coordinated optimized and sustainable manner. An organization needs to start with a clear understanding of what is needed and what is possible. An organization's objectives, and the context of an organization, can have a significant influence on the elements of its asset management system. The organization should give consideration to stakeholder expectations, its regulatory framework, geographical, cultural and industry sector factors, as well as its mixture and complexity of assets, asset types and asset systems, in deciding on what is required to meet its organizational objectives.

The organization should establish an asset management system that includes suitable process elements, controls, capabilities, and decision-making authorities, for an integrated approach to asset value realization.

2.5.2.2 Leadership

Asset management requires coherent direction and leadership from top management (see ISO 55001, clause 5.1) and delivery by appropriately empowered and competent people. 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, or the lack of understanding of such aspirations, or the lack of cross-functional collaboration to deliver them, can lead to inefficient and ineffective working and wasted effort, as well as considerable frustration and de-motivation. For some organizations this can require a change in culture, and the establishment of new behaviours and ways of thinking.

Successful, sustained asset management requires an organizational structure of roles, responsibilities and authority which facilitates the implementation of the asset management system and applies the asset management principles (see ISO 55001, clause 5.3). It is important that specific responsibility for the overall asset management system is assigned within the top management, in order to ensure continued alignment between organizational objectives and asset management processes. This responsibility can then be cascaded down to different levels within the organization, ensuring alignment and coordination.

2.5.2.3 Asset management policy and planning

2.5.2.3.1 General

An organization's asset management policy (see ISO 55001, clause 5.3) records the organization's commitment to its objectives, the principles that will be applied, and commitments to achieving them. It is an important input to asset management planning, along with objectives derived from other sources, including the organization's strategic plan, its mission, vision and values, and input from interested parties targeted at the asset management level.

The organization's planning processes (see ISO 55001, clause 6.2.2) should convert its policy and objectives into plans for specific activities. Asset management planning should start by setting asset management objectives for delivering the organizational objectives (and which apply the asset management policy). This should provide the basis for building a long term plan that covers the entire asset portfolio. Often referred-to as an asset management strategy, or strategic approach, it should cover the desired methods, processes and activities that have been selected for managing the assets, while taking account of the full asset life cycles and the period(s) of responsibility. There should be a multi-disciplinary planning process, with strong leadership support, in order to deliver an integrated and robust basis from which detailed plans can be derived. Risk management should be an essential part of this activity, as well as contingency planning.
The asset management system itself should be developed continually. The development of the asset management system should be carefully planned, prioritized and staged (see ISO 55001, clause 6.1.1). The plan for improving the asset management system should be closely linked to requirements derived from the asset management objectives and strategic approach to asset management.

2.5.2.3.2 People, organization and communication

Good asset management is highly dependent upon competent, well-motivated, people. An asset management system assures this through the development of a competency approach that includes the provision of education, training, evaluation and feedback, to produce the desired competency (see ISO55001, clause 7.2). This activity should be done at multiple levels, across the organization.

Asset management is a comprehensive, integrated activity, requiring teamwork and collaboration. Awareness of direction, priorities, processes and the roles of different parties is important to achieving this. An asset management system can give assurance that everyone in the organization is aware of the commitment to deliver the stated objectives, the obligations created by the asset management policy, and the planning and decision-making criteria and activities being taken to maximize value.

Two-way communication, both vertical and horizontal, across the organization is critical (see ISO55001 clause 7.4). The organization’s communication processes should be supported by explicit strategies, activities, resources, review and continual improvement.

2.5.2.3.3 Management of risks and opportunities

The organization should manage its risks and opportunities at many levels, from the operating and technical, to enterprise-wide. Risk management is an essential supportive element of an asset management system, and covers asset-related risks, activity-related risks and the risks associated with the operation of the asset management system itself (see ISO 55001, clause 6.1). The organization's risk management processes should consider improvement opportunities and other sources of internal and external uncertainty. The risk management processes usually involve activities, procedures, competencies and enabling information systems that should be integrated into the organization’s overall risk management framework. Asset-related, asset management-related, and asset management system-related, risk management includes the identification, evaluation, control, review and contingency planning for potential events, adverse circumstances, non-conformities, opportunities and uncertainties. Proactive identification of potential improvement opportunities can provide a significant benefit within an asset management system. Risk management plans can be either fully integrated into the asset management plan, or created separately and cross-referenced.

2.5.2.3.4 Information management

Information management is an important supporting element, and covers the collection, usage and management of relevant asset-related data, information and knowledge. It should include information technology roles and usages, and the documentation of information, along with the formal documentation of the entire asset management system, i.e. what is done, how, and the records of control, responsibilities and coordination (see ISO 55001 clauses 7.5 and 7.6). This can ensure that a consistent reference is available to all involved – a ‘single source of truth’.

2.5.2.4 Continual improvement

In addition to ‘top-down’ directional alignment, ‘bottom-up’ influences and several feedback processes, continual improvement is needed to ensure an effective, integrated system (see ISO 55001, clauses 9 and 10). Asset realities (for example, asset condition, performance and capability) should influence the asset management objectives, strategies and plans and, where appropriate, provide inputs into the organization’s objectives and stakeholder expectations. Such bottom-up contributions can require proactive monitoring of the assets and asset systems in relation to utilization demands, new opportunities and current or expected constraints. Performance monitoring of the assets, asset systems and asset life activities can be vital for the continual improvement of asset management objectives, strategies, plans, the asset management system and asset management capabilities.
The key steps within continual improvement processes are:

a) **performance monitoring and evaluation** – actively looking for non-conformities, real or potential problems, improvement opportunities or success examples (see ISO 55001, clause 9)

b) **investigation and evaluation** – understanding why the observed symptoms have occurred, and the identification, evaluation and selection of the best value responses, risk controls or improvement actions (see ISO 55001, clause 9.1)

c) **improvement actions** – ensuring that the improvements are implemented, including any necessary change management processes, and, where appropriate, validated (see ISO 55001, clause 10).

d) **communication and management of change** - ensuring that changes are adequately communicated to relevant stakeholders (see ISO 55001, clauses 7.4 and 8.2).

The asset management system should enable such steps, and provide the means of demonstrating that continual improvement is active and sustained.

### 2.5.3 Integration and alignment of the elements

#### 2.5.3.1 Directional alignment

A distinctive feature of an asset management system should be a transparent series of connections between the organization's objectives and strategic plan, and the derived asset management policies, strategic approach, plans and delivery activities. This can be achieved by a logical, phased planning process both in the determination of what is worth doing and when in an asset's life, and also in developing the required asset management capabilities and the asset management system itself.

![Figure 3: Top-down alignment of direction and what needs to be done and why.](image)

Successful top-down alignment should mean that the **reason** for activities is understood right down to the operational task level, and is visibly derived from one or more of the organization's stated objectives. This can often involve translating the language commonly used by top management (in communication with stakeholders, or in 'mission statements', or strategic objectives) into language which can be understood by
operational staff. For example, a business objective to raise overall customer service levels by 10% over the next 3 years should be distilled into specific asset management objectives such as “reducing the mean time to repair defects in the XYZ system by 15%”. The asset management planning process should convert long term organizational objectives into measurable asset management objectives, specific cost/risk/performance optimized activity plans, resource commitments and timings. This can often be a multi-stage process, so it is particularly important that the committed organizational and asset management policies, principles, values and risk frameworks are used in each phase, to shape and influence the emerging activity details and their prioritization.

2.5.3.2 Cross-disciplinary coordination of life cycle activities (horizontal alignment)

One of the challenging aspects of establishing an asset management system can be the breaking down of inter-departmental barriers, short-termism and localized self-interests; yet these are also some of the most important changes, yielding some of the biggest organizational performance benefits. There can often be divisions of responsibility for the delivery of different asset life activities, which require specialist resources and competencies, and be subject to different regulatory or other constraints. Individual functional contributions can also have activity-specific policies, planning processes, and delivery standards. These functional management requirements should be coordinated to maximize their combined contribution to asset management objectives, and should be consistent with the organizational and asset management policies, principles, plans and risk management framework.

Separate budgets and localized performance measures can often be assigned to different functional departments responsible for the different asset life activities, and even personal recognition and reward systems can become strongly associated with delivery of component activities, rather than the delivery of the asset management objectives. The asset management system should provide the means of collaboration between such departments and individuals, ensuring that overall value (as defined by the organization’s objectives and priorities) always outweighs the individual or departmental self-interests. For example, cultural and motivational differences can often be found between those responsible for acquiring, designing or creating assets, and those who operate or maintain them. In such cases, the different groups should commit to maximizing total value realization, over the whole asset life or the whole responsibility period (if less than the asset whole life), as the correct basis for determining what is worth doing, and when.

2.5.4 Authority and responsibility for the asset management system

Good asset management requires coherent direction and leadership from top management and delivery by appropriately empowered and competent people. Unless a clearly articulated organizational direction and set of priorities are provided, it can be very difficult for the organization to determine how best to manage its assets. Conflicting priorities and messages, or the lack of understanding of such aspirations, or the lack of cross-functional collaboration to deliver them, can lead to inefficient and ineffective working and wasted effort, as well as considerable frustration and de-motivation. For some organizations this can require a change in culture, and the establishment of new behaviours and ways of thinking.

Successful, sustained asset management requires an organizational structure which facilitates the implementation of the asset management system and applies the asset management principles. Specific responsibility for the overall asset management system should be assigned within the top management, in order to ensure continued alignment between the organizational objectives and asset management processes.

2.5.5 Attributes of an asset management system

To support the implementation of the asset management principles, an asset management system should have the following attributes:

a) Achievement oriented. The organization should be able to use the asset management system to determine from its organizational objectives the required performance for the assets of the organization, and when, and for how long, that performance is required to be delivered. Further, the asset management system should enable the development of asset management plans that when implemented, can achieve the organizational objectives. To support the achievement of the organization’s objectives, the asset management system should provide processes and activities that are risk-based, and which give
assurance that the methodology is able to determine and manage the risks associated with the achievement of the organization’s objectives.

b) **Transparency of decision-making.** The asset management system should contain most, if not all, of the information, records and data associated with asset management decisions. Furthermore, the methods of decision-making should be clear, consistent and based upon the search for optimal value. To enable such transparency, the asset management system should provide a capability to establish an audit trail of decision-making and enable users of the asset management system to review the basis and robustness of decisions.

c) **Establishes accountability and responsibility.** The asset management system should clearly establish accountabilities and responsibilities, including any delegated authorities, to support decision making within the organization. Such processes can provide assurance to management that the risks associated with asset management are both identifiable and controllable.

d) **Organizational integration.** The asset management system should provide for the integration of its activities and responsibilities with other functional areas of the organization. As asset management plans are developed, tasks and activities that could need to be undertaken by other functional groups should be determined. Further, as asset management plans are implemented, resources outside the asset management system might need to be accessed. An asset management system can integrate those requirements with the other functional areas of the organization, such as finance, human resources, information technology, spares/logistics, and operations.

### 2.5.6 Relationship with other organizational functions, management systems and standards

#### 2.5.6.1 Relationship with the organization’s financial management

Asset management should interface with other functions of the organization, such as human resource management; financial management; legal compliance etc. The relationship between asset management and financial management is discussed here due to the strong interaction between these two functions for asset intensive organizations.

Expenditure on assets, and where appropriate, the revenue generated by assets, will be a major part of financial management for asset intensive organizations. Long term financial planning for such organizations depends on how their assets are managed and the performance they deliver.

The financial management and reporting requirements should take consideration of the following issues, in addition to those stipulated by relevant financial standards and guidance documents:

- recognizing the consumption of asset value potential
- categorizing revenues and expenditure appropriately
- allocating costs to assets as far as practical, at an appropriate level
- preparing short, medium and long term financial forecasts.

For asset intensive organizations, the periodical financial reports should incorporate inputs from the asset management system. The financial reports are of interest to top management in the organization as well as a broad range of external and internal stakeholders.

Whatever the asset types being managed, the financial implications of asset management activities should be aligned with the financial planning, reporting and decision-making processes of the organization.

To facilitate financial planning and reporting, a close working relationship should exist between the organization’s financial management and asset management functions, including:

- using a common taxonomy for financial and technical terms
- a traceable link between technical asset inventory data and the accounting register
— a data registration process that enables the organization to record all technical and operational changes in a correct and timely manner.

Linking asset management and financial management allows an assessment of the financial position and funding requirements of the organization and appraisal of alternatives for the acquisition, enhancement or disposal of assets or asset portfolios. Robust financial data and information relating to assets are essential for such assessments, including future demand and revenue forecasts, life cycle costs, asset investment plans and the potential risks and opportunities.

2.5.6.2 Relationship with other asset management and technical standards

The ISO 5500x set of International Standards may be used in combination with any relevant sector or asset type-specific asset management standards and technical specifications. ISO 55001 specifies “what” should be in place for effective asset management, whereas other standards detail sector-specific requirements, asset-specific or activity-specific technical requirements or give guidance on “how” ISO 55001 should be interpreted and applied within an industrial sector or to particular asset types.

An asset management system should be compatible with other management systems and enterprise-wide functions as illustrated by figure 4. By using a common structure for all management systems, organizations should be able to maintain coordinated control and minimize duplication of shared elements. This does not directly correspond with the natural sequence of processes and linkages for asset management but allows consistency with other management systems.

![Figure 4: Relationship with other management systems](image_url)

3 Terms and definitions

3.1 General terms

3.1.1 audit
systematic, independent and documented process (3.1.19) for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled

Note 1 to entry: An audit can be an internal audit (first party) or an external audit (second party or third party), and it can be a combined audit (combining two or more disciplines).

Note 2 to entry: “Audit evidence” and “audit criteria” are defined in ISO 19011.

3.1.2 capability
c<asset management>
measure of the ability of an entity (system, person, or organization) to achieve its objectives (3.1.12)

Note 1 to entry: Asset management capabilities include processes, resources, competencies and technologies to enable the effective and efficient development and delivery of asset management plans and asset life activities, and their continual improvement.

3.1.3 competence
ability to apply knowledge and skills to achieve intended results

3.1.4 conformity
fulfilment of a requirement (3.1.20)

3.1.5 continual improvement
recurring activity to enhance performance (3.1.16)

3.1.6 correction
action to eliminate a detected nonconformity (3.1.11)

3.1.7 documented information
information required to be controlled and maintained by an organization (3.1.13) and the medium on which it is contained

Note 1 to entry: Documented information can be in any format and media and from any source.

Note 2 to entry: Documented information can refer to

– the management system (3.4.2), including related processes (3.1.19)

– information created in order for the organization to operate (documentation)

– evidence of results achieved (records).

3.1.8 effectiveness
extent to which planned activities are realized and planned results achieved

3.1.9 monitoring
determining the status of a system, a process (3.1.19) or an activity
ISO/CD 55000.2

Note 1 to entry: To determine the status there may be a need to check, supervise or critically observe.

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.15]

3.1.10 measurement process (3.1.19) to determine a value

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.16]

3.1.11 nonconformity non-fulfilment of a requirement (3.1.20)

Note 1 to entry: Nonconformity can be any deviation from: asset management system (3.4.2) requirements; relevant work standards, practices, procedures, legal requirements, etc.

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.19, modified – Note 1 to entry has been added]

3.1.12 objective result to be achieved

Note 1 to entry: An objective can be strategic, tactical, or operational.

Note 2 to entry: Objectives can relate to different disciplines (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process (3.19)).

Note 3 to entry: An objective can be expressed in other ways, e.g. as an intended outcome, a purpose, an operational criterion, as an asset management objective or by the use of other words with similar meaning (e.g. aim, goal, or target).

Note 4 to entry: In the context of asset management systems standards asset management objectives are set by the organization, consistent with the asset management policy, to achieve specific measurable results.

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.08, modified – Note 4 to entry has been modified]

3.1.13 organization person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives (3.1.12)

Note 1 to entry: The concept of organization includes, but is not limited to sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.01]

3.1.14 organizational strategic plan organization's goals and objectives (3.1.12) and means for achieving them

Note 1 to entry: Some organizations call this a "corporate plan", "corporate strategic plan" or "business plan".

3.1.15 outsource, verb make an arrangement where an external organization (3.1.13)performs part of an organization’s function or process (3.1.19)

Note 1 to entry: An external organization is outside the scope of the management system, (3.4.2) although the outsourced function or process is within the scope.
3.1.16 performance
measurable result

Note 1 to entry: Performance can relate either to quantitative or qualitative findings.

Note 2 to entry: Performance can relate to the management of activities, processes, products (including services), systems or organizations.

3.1.17 plan
detailed formulation of a programme to achieve an objective

NOTE 1 to entry: An asset management plan can be for an asset, asset type, class, asset system or asset portfolio.

3.1.18 policy
intentions and direction of an organization as formally expressed by its top management.

3.1.19 process
set of interrelated or interacting activities which transforms inputs into outputs

3.1.20 requirement
need or expectation that is stated, generally implied or obligatory

Note 1 to entry: “Generally implied” means that it is custom or common practice for the organization and stakeholders that the need or expectation under consideration is implied.

Note 2 to entry: A specified requirement is one that is stated, for example in documented information.

3.1.21 risk
effect of uncertainty on objectives

Note 1 to entry: An effect is a deviation from the expected — positive and/or negative.

Note 2: Objectives can relate to different disciplines (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3 to entry: Risk is often characterized by reference to potential events (ISO Guide 73, 3.5.1.3) and consequences (ISO Guide 73, 3.6.1.3), or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood (ISO Guide 73, 3.6.1.1) of occurrence.

Note 5 to entry: Uncertainty is the state, even partial, of efficiency of information related to, understanding or knowledge of, an event, its consequence, or likelihood.
Note 6 to entry: In the context of management system objectives are set by the organization, consistent with the policy, to achieve specific results. When applying the term risk and components of risk management, this should be related to the objectives of the organization that include, but are not limited to the objectives as specified in 6.2 of the common MSS text.


3.1.22 stakeholder
person or organization (3.1.13) that can affect, be affected by, or perceive themselves to be affected by a decision or activity

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.02]

3.1.23 top management
person or group of people who directs and controls an organization (3.1.13) at the highest level

Note 1 to entry: Top management has the power to delegate authority and provide resources within the organization.

Note 2 to entry: If the scope of the management system (3.4.2) covers only part of an organization then top management refers to those who direct and control that part of the organization.

[SOURCE ISO/TMB/TAG13-JTCG/N316, T.3.05]

3.2 Terms relating to ‘assets’

3.2.1 asset
something that has potential or actual value to an organization (3.1.13)

Note 1 to entry: Value can be tangible or intangible, financial or non-financial; and includes consideration of risks and liabilities, It can be positive or negative at different stages of the asset’s life

Note 2 to entry: For most organizations, physical assets usually refer to equipment, inventory and properties owned by the organization. Physical assets are the opposite of intangible assets, which are non-physical assets such as leases, brands, intellectual property rights, reputation or agreements.

Note 3 to entry: A grouping of assets referred to as an asset system (3.2.6) could also be considered as an asset.

3.2.2 asset life
period from conception to end of life

3.2.3 asset life cycle
all of the stages that an asset experiences over the asset life (3.2.2)

Note 1 to entry: The number and naming of the stages and the activities under each stage are usually determined by the organization

3.2.4 asset life cycle stage
identifiable segment of an asset’s life cycle (3.2.3)

Note 1 to entry: The number and naming of the stages and the activities under each stage are usually determined by the organization
3.2.5
**asset portfolio**
assets that are within the scope of the asset management system

3.2.6
**asset system**
set of assets (3.2.1) that interact or are interrelated

3.2.7
**critical asset**
asset (3.2.1) having potential to impact on the achievement of the organization’s (3.1.13) objectives.

Note 1 to entry: Assets (3.2.1) can be safety-critical, environment-critical or performance-critical, and can relate to legal, regulatory or statutory requirements.

Note 2 to entry: Critical assets can refer to those assets necessary to provide services to critical customers.

Note 3 to entry: Asset systems (3.2.5) can be distinguished as being ‘critical’ in a similar manner to individual assets.

3.3 Terms relating to ‘asset management’

3.3.1
**asset management**
coordinated activities of an organization (3.2.13) to realize value from assets (3.2.1)

Note 1 to entry: Value can be tangible or intangible, financial or non-financial

Note 2 to entry: Value includes consideration of risks and liabilities, and can be positive or negative at different times in the asset life

Note 3 to entry: Realization of value will normally involve an optimization of costs, risks, opportunities and performance benefits.

Note 4: to entry: When asset outputs or required service levels are pre-determined and non-negotiable, or when value is negative (e.g. dominated by risks or liabilities), "realize value" can represent minimizing the combination of costs and risks.

3.3.2
**preventive action**
action to eliminate the cause of a potential non conformity (3.1.11) or other undesirable potential situation.

Note 1 to entry: This definition is specific to `asset management (3.3.1) activities only.

Note 2 to entry: There can be more than one cause for a potential nonconformity.

Note 3 to entry: Preventive action is taken to prevent occurrence and to preserve an assets function whereas corrective action is taken to prevent recurrence.

Note 4 to entry: Preventive action is normally carried out while the asset is functionally available and operable or prior to the initiation of functional failure.

Note 5 to entry: Preventive action includes the replenishment of consumables where the consumption is a functional requirement.

[SOURCE: ISO 9000:2005, 3.6.4, modified – Note 3 to entry has been modified; Notes 1, 4 and 5 have been added]

3.3.3
**predictive action**
action to monitor the condition of an asset (3.2.1) and predict the need for preventive (3.3.3) or corrective actions.
Note 1 to entry: Predictive action is also commonly referred to as either "condition monitoring" or "performance monitoring".

3.3.4 level of service
parameters or combination of parameters that reflect social, environmental and economic outcomes that the organization (3.2.13) has agreed to deliver

Note 1 to entry: The parameters can include: safety, customer satisfaction, quality, quantity, capacity, reliability, responsiveness, environmental acceptability, cost and availability, etc.

3.3.5 life cycle costs
<asset management>
total cost of an asset (3.2.1) over its life cycle: (3.2.3)

Note 1 to entry: Total costs can include risks, asset performance losses and other business impacts

3.4 Terms relating to ‘asset management system’

3.4.1 corrective action
action to eliminate the cause of a nonconformity and to prevent recurrence

Note 1 to entry: In the case of other undesirable outcomes, action is necessary to minimise or eliminate the causes and to reduce the impact or prevent recurrence. Such actions fall outside the concept of "corrective action" in the sense of this definition.

Note 2 to entry: The system elements include the organization’s structure, roles and responsibilities, planning, operation, etc.

Note 3 to entry: The scope of a management system may include the whole of the organization, specific and identified functions of the organization, specific and identified sections of the organization, or one or more functions across a group of organizations.

Note 4 to entry: The asset (3.2.1) management system also includes the strategies and plans

Note 5 to entry: The asset (3.2.1) management system also includes the strategies and plans

Note 6 to entry: The asset (3.2.1) management system also includes the strategies and plans

Note 7 to entry: The asset (3.2.1) management system also includes the strategies and plans

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.21, modified – Note 1 to entry has been added]

3.4.2 management system
set of interrelated or interacting elements of an organization (3.2.13) to establish policies (3.1.18) and objectives (3.1.12) and processes (3.1.19) to achieve those objectives

Note 1 to entry: A management system can address a single discipline or several disciplines.

Note 2 to entry: The system elements include the organization’s structure, roles and responsibilities, planning, operation, etc.

Note 3 to entry: The scope of a management system may include the whole of the organization, specific and identified functions of the organization, specific and identified sections of the organization, or one or more functions across a group of organizations.

Note 4 to entry: The asset (3.2.1) management system also includes the strategies and plans

[SOURCE: ISO/TMB/TAG13-JTCG/N316, 3.04, modified – Note 4 to entry has been added]
Annex A
Commonly used terms
(informative)

The following terms have common dictionary definitions that are suitable for use in this International Standard; however, as they are usually given with multiple definitions in dictionaries, this annex provides guidance on which is the preferred definition. This listing is taken from document ISO/TMB/TAG13-JTCG/N318.

Table A.1 – Commonly used terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>ability to be ahead of others in assuming responsibility and authority</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Plan</td>
<td>detailed formulation of a programme to achieve an objective</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Programme</td>
<td>planned series of steps, projects or activities to be carried out</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Framework</td>
<td>underlying structure</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Design</td>
<td>working out the form, fit or function of something</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Purpose</td>
<td>anticipated (intended or expected) outcome that guides planned actions</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Determine</td>
<td>establish or find out</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Define</td>
<td>state or describe exactly the nature, scope or meaning of that which is under consideration</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Identify</td>
<td>establish the identity of something</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Verification</td>
<td>confirmation, through provision of objective evidence, that specified requirements have been fulfilled</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Efficiency</td>
<td>process which results in saving resources, E.g. money, time, etc</td>
<td>ISO Guide 83 Common terms</td>
</tr>
<tr>
<td>Alignment</td>
<td>Arrangement in a straight line or in correct relative position</td>
<td>Oxford Dictionary</td>
</tr>
<tr>
<td>Principle</td>
<td>fundamental truth or proposition that serves as the foundation for a system of belief or behaviour or for a chain of reasoning</td>
<td>Oxford Dictionary</td>
</tr>
<tr>
<td>Type</td>
<td>category of people or things having common characteristics</td>
<td>Oxford Dictionary</td>
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<tr>
<td>Attribute</td>
<td>quality or feature regarded as a characteristic or inherent part of someone or something</td>
<td>Oxford Dictionary</td>
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<tr>
<td>Systemic</td>
<td>relating to a system, especially as opposed to a particular part</td>
<td>Oxford Dictionary</td>
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<tr>
<td>Systematic</td>
<td>done or acting according to a fixed plan or system; methodical</td>
<td>Oxford Dictionary</td>
</tr>
<tr>
<td>Outcome</td>
<td>the way a thing turns out; a consequence</td>
<td>Oxford Dictionary</td>
</tr>
<tr>
<td>Element</td>
<td>an essential or characteristic part of something abstract</td>
<td>Oxford Dictionary</td>
</tr>
<tr>
<td>Criterion</td>
<td>a principle or standard by which something may be judged or decided</td>
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# Annex B:
Mapping of the ‘concepts’ in ISO 55000
with the ‘requirements’ in ISO 55001
(informative)

Table B.1 – Mapping of the 'concepts' in ISO 55000 with the 'requirements' in ISO 55001

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* applies to both asset management and asset management system
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[1] ISO 55001 Asset management – Management systems - Requirements
[17] ISO 21500 Guidance on project management
[23] BS 3811:1993, Glossary of terms used in terotechnology, British Standards Institution (BSI)
NOTE: This is not a comprehensive bibliography and individual countries will have similar or additional guidance material and standards.
Asset management — Management systems — Requirements

Gestion d’actifs — Systèmes de management — Exigences

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 55001 was prepared by Project Committee ISO/TC 251, Asset Management.

Notes on this draft

Text in blue, is that which is given by ISO’s Draft Guide 83 (from the ISO/TMB/TAG13-JTCG, document JTCG/N316)

Text highlighted in green, represents expected or permitted customization of the JTCG/N316 text

Text in black is ISO/PC 251 original text
Introduction

This International Standard specifies the requirements for the establishment, implementation, maintenance and improvement of an asset management system.

This International Standard can be used by any organization and can be applied to all types of assets. An organization should determine to which of its assets this International Standard applies. The requirements of this International Standard should be applied in their entirety to the assets determined by the organization.

This International Standard is primarily intended for use by

— those involved in the establishment, implementation, maintenance, and improvement of management system for the management of assets,
— those involved in delivering asset management activities and service providers,
— those seeking to declare, confirm, self-assess or obtain certification of conformity to this International Standard,
— internal and external parties, including certification bodies, to assess the organisation’s ability to meet legal, regulatory and contractual requirements and the organisation’s own requirements.

The order in which requirements are presented in this International Standard does not reflect their importance or imply the order in which they are to be implemented.

Further guidance regarding the application of the requirements within this International Standard is provided in ISO 55002 Asset management – Management systems – Guidelines on the application of ISO 55001

General information on asset management, and information on the terminology applicable to this International Standard, is provided in ISO 55000 Asset management – Overview, principles and terminology.

This International Standard applies ISO’s common structure and identical text for management system standards (see document ISO/TMB/JTCG/N316) and is aligned with all other management system standards that have done so similarly.

It is important to note that this International Standard applies the definition of "risk" given in ISO 31000, in preference to the definition given in ISO/TMB/JTCG/N316.

This International Standard is designed to enable an organisation to align and integrate its asset management system with related management system requirements.
Asset management — Management systems — Requirements

1 Scope

This International Standard specifies requirements for an asset management system within the context of the organization.

This International Standard can be applied to the management of all types of assets.

NOTE 1 This International Standard is particularly intended to be applied to the management of physical assets, but this does not limit application of the principles to other asset types.

This International Standard is applicable to all types and sizes of organization.

This International Standard does not specify financial, accounting, or technical requirements for the management of specific asset types.

NOTE 2 Conformity to this International Standard can be demonstrated by the organization either:

a) making a self-determination and self-declaration,

b) obtaining confirmation of its conformance by parties having an interest in the organization, such as customers,

c) obtaining certification/registration of its asset management system by an external organization.

2 Normative reference

The following document, in whole or in part, is normatively referenced in this document and is indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 55000 Asset management — Overview, principles and terminology

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 55000 Asset management — Overview, principles and terminology apply.

4 Context of the organization

4.1 Understanding the organization and its context

The organization shall determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcome(s) of its asset management system.
4.2 Understanding the needs and expectations of stakeholders

The organization shall determine

— the stakeholders that are relevant to the asset management system
— the requirements of these stakeholders
— the requirements for recording and reporting, including financial information
— the criteria for asset management decision making, and
— the requirements for reporting internally or externally about the management of the assets.

4.3 Determining the scope of the asset management system

The organization shall determine the boundaries and applicability of the asset management system to establish its scope. When determining this scope the organization shall consider:

— the external and internal issues referred to in 4.1
— the requirements referred to in 4.2, and
— how the asset management system supports delivery of the organisational strategic plan(s).

The organization shall determine to which of its assets this International Standard applies.

The scope shall be available as documented information

4.4 Asset management system

The organization shall, establish, implement, maintain and continually improve an asset management system, including the processes needed and their interactions, in accordance with the requirements of this International Standard.

5 Leadership

5.1 Leadership and commitment

Top management shall demonstrate leadership and commitment with respect to the asset management system by

— ensuring alignment of the asset management system approach to managing risks and opportunities to the organization's approach to managing strategic and/or corporate risk
— ensuring that policies and objectives are established for the asset management system and are compatible with the strategic direction of the organization

NOTE 1 The policies and objectives referred to above relate to asset management policies and objectives, as well as any objectives for the asset management system.

— ensuring the integration of the asset management system requirements into the organization's business processes
— ensuring that the resources for the asset management system are available
—— communicating the importance of effective asset management and of conforming to the asset management system requirements
—— ensuring that the asset management system achieves its intended outcome(s)
—— directing and supporting persons to contribute to the effectiveness of the asset management system
—— promoting continual improvement
—— supporting other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility
—— ensuring alignment between the organizational strategic plan(s) and the asset management objectives, and
—— being responsible for the asset management system, irrespective of other responsibilities.

NOTE 2 Reference to “business” in this International Standard should be interpreted broadly to mean those activities that are core to the purposes of the organization’s existence.

5.2 Policy

Top management shall establish an asset management policy that
—— is appropriate to the purpose of the organization
—— provides a framework for setting asset management objectives
—— includes a commitment to satisfy applicable requirements
—— includes a commitment to continual improvement of the asset management system

The asset management policy shall;
—— be available as documented information
—— be communicated within the organization
—— be available to stakeholders, as appropriate
—— be consistent with the organizational strategic plan(s)
—— be consistent with other organizational policies
—— be implemented, reviewed and updated periodically
—— be appropriate to the nature and scale of the organization’s assets and operations

5.3 Organizational roles, responsibilities and authorities

Top management shall ensure that the responsibilities and authorities for relevant roles are assigned and communicated within the organization.

Top management shall assign the responsibility and authority for

a) ensuring that the asset management system supports delivery of the organisational strategic plan(s)
b) ensuring that the asset management system conforms to the requirements of this International Standard

c) approval of the asset management plan(s)

d) reporting on the performance of the asset management system to top management

6 Planning

6.1 Actions to address risks and opportunities

6.1.1 Planning for the asset management system

When planning for the asset management system, the organization shall consider the issues referred to in 4.1 and the requirements referred to in 4.2 and determine the risks and opportunities that need to be addressed to

— assure the asset management system can achieve its intended outcome(s)
— prevent, or reduce undesired effects
— achieve continual improvement

The organization shall plan:

a) actions to address these risks and opportunities, and

b) how to

— integrate and implement the actions into its asset management system processes
— evaluate the effectiveness of these actions.

6.1.2 Planning for assets

The organization shall establish, implement and maintain processes for the ongoing determination, analysis and evaluation of asset-related risks, and shall:

a) assess the risks that assets do not deliver on the organization’s objectives, including risks that can arise from changes in the external context

b) consider risks that change with time

c) ensure that adequate resources are available to apply appropriate risk controls

d) ensure that its asset management system, asset management, and asset related risks are integrated into the organization’s risk management approach

NOTE External context includes political, environmental, safety, social, technical, legislative, contractual, legal, regulatory and economic circumstances.

e) integrate its action plan(s) into review processes and cycles (see 9.1).

6.2 Asset management objectives and planning to achieve them

6.2.1 Asset management objectives

The organization shall establish asset management objectives at relevant functions and levels.
When establishing its objectives, the organization shall consider the expectations of relevant stakeholders, and other financial, technical or organisational requirements.

The asset management objectives shall

- be consistent with the organizational objectives
- be consistent with the asset management policy
- be measurable (if practicable)
- take into account applicable requirements
- be monitored
- be communicated to relevant stakeholders
- be updated as appropriate
- be consistent with the possibilities and aims of the organization in achieving the required asset management performance
- be based on asset management decision making criteria

The organization shall retain documented information on the asset management objectives.

6.2.2 Asset management planning

The organization shall establish, document and maintain asset management plan(s) to achieve the organizational objectives. These plan(s) shall be in accordance with the asset management policy and the criteria determined in 6.2.1 to deliver the asset management objectives. The organization shall develop a strategic approach using the criteria for asset management decision making (see 4.2).

The application methodology for prioritizing investments in its asset management plan(s) shall be documented.

When planning how to achieve its asset management objectives, the organization shall determine

- the strategic approach and methods to be employed in managing its assets over their lifecycle
- what will be done
- what resources will be required
- who will be responsible
- when it will be completed
- how the results will be evaluated
- the appropriate time horizon for the asset management plan(s)
- the financial and risk implications of the asset management plan(s)
- the review period for the asset management plan(s).
7 Support

7.1 Resources

The organization shall determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the asset management system.

The organization shall provide the resources required for meeting the asset management objectives as specified in the asset management plan(s).

7.2 Competence

The organization shall:

— determine the necessary competence of person(s) doing work under its control that affects its asset management performance, and

— ensure that these persons are competent on the basis of appropriate education, training, or experience,

— where applicable, take actions to acquire the necessary competence, and evaluate the effectiveness of the actions taken, and

— retain appropriate documented information as evidence of competence.

— periodically review current and future competency needs and requirements

NOTE Applicable actions may include, for example; the provision of training to, the mentoring of, or the reassignment of currently employed persons; or the hiring or contracting of competent persons.

7.3 Awareness

Persons doing work under the organization’s control, who have the potential to impact on the achievement of the asset management objectives, shall be aware of:

— the asset management policy

— their contribution to the effectiveness of the asset management system, including the benefits of improved asset management performance

— the implications of not conforming with the asset management system requirements.

7.4 Communication

The organization shall determine the need for internal and external communications relevant to the assets, asset management and asset management system including

— on what it will communicate

— when to communicate

— with whom to communicate

— how to communicate.

The asset management plan(s) shall be communicated to relevant stakeholders.
7.5 Information system support

The organization shall determine its information requirements to support its assets, asset management and asset management system, in order to meet the requirements of this International Standard and to support the achievement of its organizational objectives. In doing this:

a) the organization shall give consideration to:

   — the significance of the identified risks
   — the management responsibilities for asset management processes
   — the financial, technical, risk, statutory, and executive authority processes and arrangements, as approved by the organization
   — the social environment within which the organization operates.
   — the exchange of information between the stakeholders, including (service providers)
   — the making of informed decisions

b) the organization shall determine

   — the (quality) attribute requirements of identified information needs
   — the methods for the collection of information (including the frequency of collection), its analysis and evaluation, in order to ensure valid results.

c) the organization shall specify, implement and maintain systems for managing its information, including attributes of all asset data (functional, physical, financial and derived).

7.6 Documented Information

7.6.1 General

The organization’s asset management system shall include

   — documented information as required by this International Standard
   — documented information determined by the organization as being necessary for the effectiveness of the asset management system

NOTE The extent of the document information for an asset management system can differ from one organization to another due to

   — the size of organization and its type of activities, processes, products and services,
   — the complexity of processes and their interactions,
   — the competence of persons, and
   — the complexity of the asset(s).

7.6.2 Creating and updating

When creating and updating documented information the organization shall ensure appropriate
identification and description (e.g. a title, date, author, or reference number)

— format (e.g. language, software version, graphics) and media (e.g. paper, electronic)

— review and approval for suitability and adequacy.

### 7.6.3 Control of documented Information

Documented information required by the asset management system and by this International Standard shall be controlled to ensure

— it is available and suitable for use, where and when it is needed

— it is adequately protected (e.g. from loss of confidentiality, improper use, or loss of integrity).

For the control of documented information, the organization shall address the following activities, as applicable

— distribution, access, retrieval and use,

— storage and preservation, including preservation of legibility

— control of changes (e.g. version control)

— retention and disposition

Documented information of external origin determined by the organization to be necessary for the planning and operation of the asset management system shall be identified as appropriate, and controlled.

**NOTE** Access implies a decision regarding the permission to view the documented information only, or the permission and authority to view and change the documented information, etc.

### 8 Operation

#### 8.1 Operational planning and control

The organization shall plan, implement and control the processes needed to meet requirements, and to implement the actions determined in 6.1 and the plan(s) determined in 6.2, by

— establishing criteria for the processes

— implementing the control of the processes in accordance with the criteria

— keeping documented information to the extent necessary to have confidence that the processes have been carried out as planned.

The organization shall control planned changes and review the consequences of unintended changes, taking action to mitigate any adverse effects, as necessary.

The organization shall ensure that outsourced processes are controlled.

#### 8.2 Management of change

Where existing arrangements are revised, or new arrangements are introduced, that could have an impact on the organization’s assets, asset management activities, asset management system or on the achievement of its objectives, the organization shall assess the associated risks before the arrangements are implemented.
The organization shall ensure that such risks are managed within its risk management approach.

8.3 Outsourcing of asset management activities

Where the organization chooses to outsource any aspect of asset management that affects conformity with the requirements of this International Standard, it shall ensure control over such aspects. The organization shall determine and document how these aspects will be controlled and integrated into the organization's asset management system. The organization shall also determine 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) the authorities and responsibilities within the organization for managing the outsourced processes and activities.

When outsourcing asset management activities, the organization shall ensure that the outsourced resources meet the requirements of clauses 7.2 to 7.6.

9 Performance evaluation

9.1 Monitoring, measurement, analysis and evaluation

The organization shall determine:

— what needs to be monitored and measured;

— the methods for monitoring, measurement, analysis and evaluation, as applicable, to ensure valid results.

— when the monitoring and measuring shall be performed;

— when the results from monitoring and measurement shall be analysed and evaluated.

The organization shall evaluate the asset management performance and the effectiveness of the asset management system.

The organization shall retain appropriate documented information as evidence of the results of monitoring, measurement, analysis and evaluation.

9.2 Internal audit

The organization shall conduct internal audits at planned intervals to provide information to assist in the determination on whether the asset management system:

a) conforms to

   — the organization's own requirements for its asset management system

   — the requirements of this International Standard;

b) is effectively implemented and maintained.

The organization shall
— plan, establish, implement and maintain an audit programme(s), including the frequency, methods, responsibilities, planning requirements and reporting. The audit programme(s) shall take into consideration the importance of the processes concerned and the results of previous audits.

— define the audit criteria and scope for each audit

— select auditors and conduct audits to ensure objectivity and the impartiality of the audit process.

— ensure that the results of the audits are reported to relevant management, and

— retain documented information as evidence of the results of the implementation of the audit programme and the audit results

9.3 Management review

Top management shall review the organization’s asset management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.

The management review shall include consideration of:

a) the status of actions from previous management reviews;

b) changes in external and internal issues that are relevant to the asset management system;

c) information on the asset management performance, including trends in:
   — nonconformities and corrective actions
   — monitoring and measurement results, and
   — audit results;

d) asset management activities;

e) opportunities for continual improvement;

f) changes in risk profile.

The outputs of the management review shall include decisions related to continual improvement opportunities and any need for changes to the asset management system.

The organization shall retain documented information as evidence of the results of management reviews.

10 Improvement

10.1 Nonconformity and corrective action

When a nonconformity occurs, the organization shall:

a) react to the nonconformity, and as applicable
   — take action to control and correct it, and
   — deal with the consequences;
b) evaluate the need for action to eliminate the causes of the nonconformity, in order that it does not occur or recur elsewhere, by
   — reviewing the nonconformity
   — determining the causes of nonconformity, and
   — determining if similar nonconformities exist, or could potentially occur;

c) implement any action needed;

d) review the effectiveness of any corrective action taken; and

e) make changes to the asset management system, if necessary.

Corrective actions shall be appropriate to the effects of the nonconformities encountered.

The organization shall retain documented information as evidence of
   — the nature of the nonconformities and any subsequent actions taken, and
   — the results of any corrective action.

When treating nonconformities, the organization shall consider the associated risks.

10.2 Continual improvement

The organization shall continually improve the suitability, adequacy and effectiveness of the asset management system.

10.3 Preventive and predictive action

The organization shall have processes to identify potential nonconformities and evaluate the need for preventive and predictive action to prevent their occurrence.

When a potential nonconformity is identified the organization shall apply the requirements of 10.1.
Bibliography

(To be developed)

Asset management — Management systems — Guidelines for the application of ISO 55001

Gestion d’actifs — Systèmes de management — Lignes directrices pour l’application de la norme ISO 55001

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 55002 was prepared by Project Committee ISO/TC 251, Asset Management.
Introduction

This International Standard provides guidance for the application of an asset management system in accordance with the requirements of ISO 55001 *Asset management – Management systems – Requirements.*

This International Standard contains explanatory text necessary to clarify the requirements specified in ISO 55001 and provides examples to support implementation. It does not specify guidance for the management of specific asset types.

This International Standard provides guidance for use by

— those involved in the establishment, implementation, operation, maintenance, and improvement of management systems for the management of assets

— those involved in delivering asset management activities and service providers

— those seeking to declare, confirm, self-assess or seek certification of conformity to ISO 55001

— internal and external parties, including certification bodies, when assessing the organization’s ability to meet the requirements of ISO 55001.

General information on asset management, and information on the terminology applicable to this International Standard, is provided in ISO 55000 *Asset management – Overview, principles and terminology.*
Asset management — Management systems — Guidelines for the application of ISO 55001

1 Scope

This International Standard provides guidance for the application of an asset management system in accordance with the requirements of ISO 55001.

This International Standard can be applied to the management of all types of assets.

NOTE This International Standard is particularly intended to be applied to the management of physical assets, but this does not limit application of the principles to other asset types.

This International Standard is applicable to all types and sizes of organization.

This International Standard does not specify financial, accounting, or technical requirements for the management of specific asset types.

This standard is not intended for use for certification purposes.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 55000:2014 Asset management — Overview, principles and terminology

ISO 55001:2014 Asset management — Management systems — Requirements

NOTE Other publications that provide information or guidance are listed in the Bibliography. It is advisable that the latest editions of such publications be consulted.

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions in ISO 55000 Asset management — Overview, principles and terminology, apply.

4 Context of the organization

4.1 Understanding the organization and its context

When establishing a management system for managing assets, it is important to evaluate the external and internal contexts of the organization, since these can significantly influence the design and scope of the asset management system.
Evaluating the organization’s external context may include, but is not limited to:

a) the social and cultural, political, legal, regulatory, financial, technological, economic, natural and competitive environment, whether international, national, regional or local;

b) key drivers and trends having impacts on the objectives of the organization; and

c) relationships with, and perceptions and values of, external stakeholders.

Evaluating the organization’s internal context may include, but is not limited to:

a) governance, organizational structure, roles and accountabilities;

b) policies, objectives, and the strategies that are in place to achieve them;

c) capabilities, understood in terms of resources and knowledge (e.g. capital, time, people, systems and technologies);

d) information systems, information flows and decision making processes (both formal and informal);

e) relationships with, and perceptions and values of, internal stakeholders;

f) the organization’s culture;

g) standards, guidelines and models adopted by the organization;

h) the form and extent of contractual relationships;

i) existing risk management plans;

j) existing asset management practices, plans, process(es) and procedure(s);

k) performance of the assets and asset systems (including but not limited to suitability, utilization, dependability, condition, longevity and costs)

l) feedback from the investigation of previous failures, incidents, accidents and emergencies

m) assessing the ability of the asset management system to achieve the intended outcomes of the organizational strategic plan.

EXAMPLE Risk and opportunity identification approaches and processes for assessing the ability of the asset management system to achieve the intended outcomes of the organization strategic plan include:

— SWOT analysis (Strengths, Weaknesses, Opportunities, Threats),

— BPEST analysis (Business, Political, Economic, Social, Technological), and

— PESTLE (Political, Economic, Social, Technical, Legal, Environmental).

4.2 Understanding the needs and expectations of stakeholders

Stakeholders are generally able to provide input into decisions that can have an impact on them, and could need to be informed before decisions are made that might affect them. Failure to both communicate and consult in an appropriate way about asset management activities can in itself constitute a risk, because it could later prevent an organization from fulfilling its objectives.

Stakeholders are likely to make judgments about asset management based on their perceptions. These can vary due to differences in values, needs, assumptions, concepts and concerns as they relate to the issues
under discussion. Since the views of stakeholders will have a significant impact on decisions, it is important that their perceptions are identified, recorded, and taken into account in the decision making process.

Examples of stakeholders include the following

— individuals within the organization

— functional groups within the organization for example engineering, accounting, maintenance, operations, purchasing, receiving, logistics etc

— customer, suppliers, service providers and contractors

— non-governmental organizations (NGOs) with an interest in issues related to asset management

— government organizations, regulatory authorities, and politicians at all levels of government

— shareholders, management consortia, government agencies

— investors or taxpayers

— local communities

— those in society interested in social, financial, environmental or other forms of sustainability

— society as a whole

— financial institutions, rating agencies, and insurers.

There are a variety of different approaches such as interviews and surveys for consulting with stakeholders and establishing an understanding of their needs. A communication plan for consulting with internal and external stakeholders should be developed. Internal and external documents, standards, regulations, safety cases, contracts and other print data may also need to be consulted.

A statement of stakeholders’ needs and expectations should be prepared. This information may be displayed in the form of a report, table or graphic. There should be a means of tracking how current the information is and from where it was sourced.

Stakeholders can have specific requirements for the recording and reporting of financial information, for example:

a) country-specific, jurisdiction or stock-exchange-specific financial reporting requirements, which the asset management system could need to meet;

b) financial and technical reporting requirements from regulators, specific to their field of activity;

c) internal and external technical and financial reporting (e.g. segment information, qualitative and quantitative technical asset type information, actual data on forecast, planning and budgeting subject matters, performance measures of asset management objectives, investments, maintenance and disposals); and

d) disclosure requirements in annual reports or other publicly available periodic reports, such as a description of the main components of the asset management system and management assertions on this description and its ability to effectively and efficiently manage the assets of the organization.

The level of detail of the additional requirements will vary from one organization to another depending on the scope of the activities and on the complexity of the assets to manage. The detail should not disclose any proprietary information.
Understanding how asset-related decisions are made is an important part of asset management. The criteria for decision making are influenced in part by an understanding of the needs of external and internal stakeholders and also by the asset management policy. Decision making criteria can be expressed in a number of ways to support quantitative, semi-quantitative or qualitative decisions. They are used to evaluate different options. An example of a qualitative decision criterion is a question such as “does the option minimise impact on the environment”, similarly for a quantitative decision criterion might require the calculation of the net present value of the option. It is important that the criteria selected are independent of each other and cover all aspects relevant to the organization. The processes to establish the decision criteria that guide asset management should be clear.

4.3 Determining the scope of the management system

Based on the outcomes of 4.1 and 4.2, the organization should define the boundaries of the asset management system by establishing its scope. This includes consideration of:

- the activities regarded as integral to the asset management system as described in 55001, such as setting asset management objectives, developing and implementing asset management plans, support, operation and improvement;
- the technical aspects, which may include reference to asset portfolio(s), assets, and technical systems;
- the organizational aspects (such as which parts of the organization are involved); and
- the interfaces with other management systems.

The scope of the asset management system should be documented in a way that is communicable to all relevant stakeholders, both internal and external to the organization. The communication may be in the form of (but not necessarily limited to) a figure or table. The detail will be influenced by the size of the organization and the scale and complexity of the asset base covered by the asset management system. It should clearly show what is considered in and out of the scope.

Having established the scope of the asset management system, there should be an assessment of the ability of the asset management system to enable the intended outcomes of the organizational strategic plan. This is the question “is the management system fit for purpose?” Processes such as, but not limited to, SWOT (Strength, Weaknesses, Opportunities, and Threats analysis) and gap analysis may be used. The intent is to determine what the mismatch or gaps are and where they exist. This analysis should be used as input to an improvement process for the asset management system.

4.4 Asset management system

In the initial design phase for the asset management system the organization should outline how it will establish, implement, maintain and improve the system. In many cases an initial design review can determine the processes that need to be developed, as they would be integral to the functioning of the system. Thought should be given to how to prioritise what to develop first, as there is usually a limit on resources available.

Elements of a typical asset management system include, but are not limited to, one or more policies, plans, written procedures, documented and undocumented processes, a database of individual asset records and (reports of) scheduled reviews or self-assessments, measures, and qualitative metrics.

The asset management system should not stand-alone. A factor of successful asset management is the ability to integrate asset management processes and activities with those of other organizational functions, for example quality, accounting, safety, risk and human resource management. Where possible existing business processes should be leveraged to avoid unnecessary new work and duplication of existing work. There are a variety of tools available such as, but not limited to, business process mapping and value stream mapping to assist in determining areas of overlap and duplication. These interactions with the existing processes need to be clearly articulated to all involved.
An organization seeking to develop and implement an asset management system which conforms to ISO 55001 should conduct a review of the organization’s current processes and compare these against the requirements of ISO 55001, to determine the extent to which the ISO 55001 requirements are being met or whether improvements are required. It is important to be aware of and clarify any variations in terminology between ISO 55000 and the terminology used in the organization’s common practice. The review should provide information which an organization can use to determine if there are any existing gaps in the asset management system with respect to the ISO 55001 requirements, and can guide the organization in formulating strategies for implementing and prioritizing improvements. It should be noted however, that compliance with all the requirements of ISO 55001 represents achieving the minimum standard for an effective asset management system and should not be seen as the final goal.

5 Leadership

5.1 Leadership and commitment

Leadership can be demonstrated by top management through influencing the organization in its execution of all the requirements of clause 5 in ISO 55001, specifically in setting the asset management policy and appointing people at a suitable level to be responsible for the asset management system.

Top management should understand the risks and opportunities of its asset management system and how it enables the delivery of the organization’s objectives. The asset management system’s risk processes should align to the organization’s risk management approach. Top management should be able to demonstrate how asset management system risk cascades from its strategic risk and how they take action and provide resourcing solutions to manage the determined risks and opportunities.

Top management should ensure that resources are provided to support the development and maintenance of the asset management system and its associated processes. The goals and measures for success should be clear, documented and communicated to the people responsible for the asset management system.

Top management commitment can be demonstrated by

— engagement in setting the goals and measures of success for the people responsible for the asset management system
— setting priorities for these goals
— allocating appropriate resources for achievement of these goals
— supporting a management-development track that encourages and rewards time spent in roles associated with asset management and operation of the asset management system.

5.2 Policy

A visible statement of top management support for asset management is an asset management policy signed by the leadership team. The asset management policy sets out non-negotiable expectations for decisions, activities, and behaviours concerning asset management. The policy elements should be derived from the organization’s mission and values in order to support delivery of the organizational strategic plan.

The asset management policy assists in ensuring alignment between the organizational strategic plan and the asset management objectives. The development of asset management objectives is discussed in more detail in clause 6.2.1. An important link is to ensure that asset management objectives are consistent with the intent of the asset management policy elements.

Examples of asset management policy elements may include commitments for:

— adherence to applicable laws and regulations.
— the provision of resources to deliver on asset management objectives
— monitoring compliance by reporting asset management metrics
— continual improvement of the asset management system.

Ongoing challenges for top management are

— to adopt and demonstrate the behaviours set out in the asset management policy, and
— to give visibility to their decisions and to ensure that they are aligned with the intent of the policy.

Failure to meet these challenges can undermine the policy in the eyes of others in the organization. An example of such failure would be to have a policy element to report asset management metrics, which when calculated and reported do not influence asset related decision making, then confidence in the metrics and in the commitment of top leaders to asset management principles would be undermined.

Top management can help to positively reinforce asset management policy by

— making reference to asset management principles in everyday rhetoric,
— using asset-related decision criteria for capital expenditures and other decisions, and
— sponsoring asset related improvement activities.

There are a variety of methods to communicate the asset management policy to stakeholders including the organization’s web site, framed policy statements in communal areas, and reference to the policy in inductions.

There should be processes in place to review and update the asset management policy and to ensure that if the organization’s external or internal context changes, then the actions necessary to update the policy are also triggered.

An organization’s asset management policy elements can be captured in other high level organizational policies. If this can be demonstrated, then a separate asset management policy document may not be required.

In some circumstances it can be useful for the organization to establish a policy and associated objectives for the asset management system itself, e.g. when a review of the performance of the asset management system determines a need for it to be improved.

5.3 Organizational roles, responsibilities and authorities

To enable the achievement of asset management objectives and plans, the responsibilities and authorities of key functions and roles within the asset management system should be defined. In addition, the roles and responsibilities of those involved in asset management processes (and how they interrelate) should be defined. Examples of these roles include, but are not limited to, asset owners, asset managers, service providers, contractors, and specific functional groups.

The organization may produce a documented organizational structure as part of its demonstration of conformity to this ISO 55001 requirement.

It should be clear which role is responsible for

— verifying that the asset management system conforms to requirements
— assessing performance of the asset management system
— reviewing asset management plans
— reporting to top management.

When assigning internal roles, consideration should be given to the following:

— an individual’s skills, experience and competence (refer to 7.2)
— support for the role through training and mentoring
— other workload requirements and their variability which could impact the individual’s ability to deliver on asset management related objectives.

For contractors and external service providers, their responsibilities may be documented in the scope or other deliverable statements in contracts.

6 Planning

6.1 Actions to address risks and opportunities

6.1.1 Planning for the asset management system

ISO 55001 requires the organization to determine the actions that are necessary for addressing risks and opportunities when planning for its asset management system. The intent is for the organization to ensure that the asset management system achieves its objectives, prevents or reduces undesired effects, identifies opportunities, and achieves continual improvement.

When planning for the asset management system, the organization should consider both external and internal issues, risks and opportunities that are relevant to its purpose and that affect its ability, either positive or negative, to achieve the intended outcome(s) of its asset management system.

The organization should also consider the ability of its asset management system to align and achieve the intended outcomes of the organizational strategic plan and any opportunities to improve its performance. The organization should also review the asset management system for risk and opportunities when it develops its strategic approach to align organizational objectives, asset management objectives and asset management system objectives.

The organization should determine the stakeholders that are relevant to the asset management system, either internal or external, understand the requirements of these stakeholders and plan for the necessary actions to address risks and opportunities. These stakeholders can include legal or regulatory authorities or contracted parties.

The organization should also link its requirements for recording and reporting of financial information in the asset management system to its approach to financial management, business planning and budgeting.

The organization should also determine the necessary criteria for asset management decision making that it applies to addressing risk and opportunities and for setting performance criteria for its asset management system. The criteria for decision-making and performance criteria should consider the organization’s approach to sustainability and the sustainment of its asset management system.

The organization should consider the risks and opportunities that can change with time and how these could impact the asset management system in the future. For example, these can include the obsolescence of business practices and technology, employee availability or competency, changing legal or regulatory requirements, or changes to critical customer requirements.

The organization should create a linkage between the actions identified that address the risks and opportunities identified above and the organizations approach to risk management and business continuity.
planning. It should also determine and plan to provide adequate resources to address the risks and opportunities.

The organization should be able to demonstrate how it has evaluated the effectiveness of the actions that it has taken to manage the risks and opportunities identified. It may do so by comparing the results achieved by its asset management system against the organization’s objectives, decision-making criteria or other required performance criteria.

6.1.2 Planning for assets

ISO 55001 requires the organization to determine the processes and actions that are needed to address risks and opportunities when planning for its assets. The intent is for the organization

— to ensure that its assets enable its intended objectives or services

— to determine, document and classify the risks, while taking action to prevent or reduce undesired effects

— to determine and take action regarding opportunities, and

— to achieve continual improvement.

The application of risk management should be consistent across all assets within the scope of the asset management system. When considering actions that address risk and opportunities, the organization should determine the approaches and actions for individual assets, networks of assets or across asset portfolios.

The organization should consider the ability of its assets to align and achieve the intended outcomes of the organizational objectives and should:

a) review its assets for risks and opportunities when it develops its strategic approach to align organizational objectives, asset management objectives, asset management system objectives and asset performance objectives;

b) review the criticality of assets related to its intended outcomes, objectives and service requirements.

In order to do so, the organization should:

a) determine the stakeholders, either internal or external, that are relevant to the services enabled by its assets and asset performance;

b) understand the requirements of these stakeholders and plan for the necessary actions to address risks and opportunities (these stakeholders can include legal or regulatory authorities, elected officials, and contracted parties);

c) consider actions to address risk and opportunities related to asset or asset system failure to its critical customers, (for example, this could include consideration of how the organization ensures the continuance of service to emergency response providers in the event of a natural disaster).

The organization should be able:

a) to demonstrate an understanding of its critical assets or critical asset networks and how their failure could impact business continuity;

b) to create and demonstrate a link between the actions that address the risks and opportunities and the organization’s approach to risk management and business continuity planning.

The organization should determine the criteria that are necessary for asset decision making and for setting performance criteria that it applies to addressing risk and opportunities of its assets. The criteria for decision-making should consider the organization’s approach to sustainability (social, environmental and economic) and/or the sustainment of its assets.
The organization should determine the risks and opportunities regarding asset performance and determine the opportunities where non-asset solutions can be appropriate. For example, a non-asset solution could include demand management.

The organization should consider the risks and opportunities that can change with time and how these can impact its assets, for example, they can include asset obsolescence, degradation and asset lifecycle requirements. Consideration of the asset lifecycle requirements should examine their impact on operations, procurement, commissioning, deactivation, disposal of assets and the management of residual liabilities. This should be done to ensure that risk and opportunities are addressed by the organization for the entire responsibility period of its assets.

The organization should determine and provide the resources needed to address the risks and opportunities. It should be able to demonstrate the application of appropriate processes to assess and control risks and link this to the organization’s approach to risk management or to an asset risk register. The asset risk register should list each risk consequence and probability of risk, and associated risk action plans to control each risk relevant to the organization.

The organization should determine and apply asset risk management analysis and practices which are aligned and considered appropriate to its overall approach to risk management. There are many approaches that may be appropriate to specific asset types or asset systems that may be used by the organization.

EXAMPLE Suitable approaches include:

— SWOT analysis (Strengths, Weaknesses, Opportunities, Threats),
— BPEST analysis (Business, Political, Economic, Social, Technological) and
— PESTLE (Political, Economic, Social, Technical, Legal, Environmental)

Risk action plans for assets, asset networks or assets portfolios should be integrated into the processes within the asset management system. Information should be available to evaluate the effectiveness of risk action plans within continuous improvement review processes and cycles.

6.2 Asset management objectives and plans to achieve them

6.2.1 Asset management objectives

The organization should determine measurable asset management objectives derived from its strategic organizational objectives and aligned to the asset management policy. Criteria for asset management decision making should support the development of asset management objectives. Objectives should be established at relevant parts of the organization, including asset management system objectives, asset management objectives and asset performance objectives, to enable policy to be implemented and expectations to be monitored.

During the establishment of asset management objectives, consultation with those people 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.

EXAMPLE 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 measureable
— 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.

The organization can use the asset management objectives to support a common understanding among stakeholders of its asset management performance. It is important therefore that they are communicated to relevant stakeholders. It is appropriate that different levels of asset management objectives are communicated to different stakeholder groups. For example outcome based objectives (e.g. satisfy a 10% demand growth) could be communicated to external industry groups, whereas output based objectives (e.g. a minimum of a 15% return on investment) could be communicated internally or to investment groups etc.

The organization should also retain documented information on the asset management objectives in order to routinely evaluate the asset management system’s ability to deliver the intended results and continually improve.

6.2.2 Asset management planning

6.2.2.1 Planning to achieve asset management objectives

The organization should establish a strategic approach that includes the establishment of asset management decision-making criteria and which aligns its organizational objectives, asset management objectives, asset management system objectives, and asset performance criteria.

A key feature of good asset management decision-making is the optimization of costs, risks and performance over short and long timeframes, within any absolute constraints. The process of optimization is critical to the credibility and effectiveness of the asset management plans.

The organization should consider the overall and long-term needs of each asset in its asset management decision making process. The best value compromise of life cycle costs, risks, performance or service losses and other negative effects on business goals (such as damage to reputation or sustainability) should be achieved in the context of a sustainable approach to meeting the overall and long-term need for assets.

The organization should plan and determine strategic approaches and actions for individual assets, networks of assets, or across asset portfolios. The organization should decide whether the strategic approach(es) should be applied consistently across all assets within the scope of the asset management system.

6.2.2.2 Strategic approach

Criteria for asset management decision making should be established and documented, setting out clearly the approach to optimization and prioritization. These criteria should be derived from the organization’s values and objectives, through a determination of asset and asset system criticality and appropriately weighted asset management objectives.

When optimizing asset management decisions, organizations should adopt robust and auditable decision methods, appropriate to the criticality and complexity of the decisions being made, and ensure consistent assumptions about the significance of contributing factors.

The asset management decisions should be documented in such a way as to define intervention cycles, or conditions for intervention, as well as approaches to financial, technical or otherwise (e.g. sustainable) prioritization and optimization of programs of activity.

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. These three major areas of optimization apply to an asset portfolio. These represent optimization of:

a) individual interventions or actions upon individual assets (such as “is this maintenance task on this equipment item worthwhile and, if so, when?”);

b) task combinations on the same asset, or different assets within an asset system:

c) the various life cycle activities for the same asset, i.e. the best combination of investment, utilization, maintenance and renewals. For example, there can 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);

d) the activities on various components of an asset system where inter-dependencies exist, such as train wheel-rail interfaces, air conditioning or cooling systems and the equipment/facilities they are protecting.

e) activity programme delivery, such as critical path identification, resource levelling and work bundling (for example, shutdown strategies, where there can be benefits for combining tasks to share access opportunities or other overheads).

The development, optimization, prioritization and integration of asset management plan(s) are iterative processes that start with the development, or update, of the overarching asset management policy, objectives and plan(s).

6.2.2.3 Scope of asset management plan(s)

The asset management plan should be documented at a level that is appropriate to the organization. For small asset portfolio’s this may be captured in a single document. For larger organizations, with multiple asset classes, asset management plans may be produced for each asset class. A portfolio level strategy can be used to set out how each plan meets the long-term asset management objectives for the organization.

Asset management plan(s) should be developed to appropriate time horizons for the organization and asset class. The time horizon should meet the organization’s needs, consider the organization’s period of responsibility (or part of it for longer periods of responsibility) and consider the typical life of the assets. Asset management plan(s) should address the full lifecycle of the assets, within the scope of the document.

Asset management plan(s) should be periodically reviewed to facilitate continuous alignment with the organization’s strategic objectives.

6.2.2.4 Financial implications of the asset management plan(s)

It is critical to the success of the asset management planning process that the necessary financial resources are committed by the organization to achieve the plan objectives. The financial implications arising from the asset management system plan(s) should be quantified. This requires linkages between the asset management system plan(s) and the financial plans of the organization, where decisions should be made about financial allocations jointly by the people responsible for the different plans. It is important that such linkages are established at the commencement of the asset management system planning process, and subsequently maintained throughout the duration of the asset management system.

Where appropriate, the organization should apply a common methodology for the integration of actions and financial expenditure from multiple plans, when prioritising its future activities.

These linkages also allow the organization to engage with its customers in negotiating and managing price – service trade-offs. This can be particularly useful for organizations operating in a regulated operating environment.

Sometimes the initial capital costs are given too much focus when evaluating asset creation and acquisition options. All lifecycle costs (such as for the initial concept development through acquisition; utilization and
support; for renewal, replacement or disposal) should be recognised in the decision making process. The long-term operational costs of an asset can be a significant component of its total lifecycle cost. The financial treatment of lifecycle costs is essential for financial and asset management. Capitalisation policies should be clearly defined and followed.

The development of an asset management plan can involve making deliberate trade-offs between short and long term issues. It also involves consideration of all the phases of an asset’s life cycle, and the potential impacts of a decision in one phase on a later stage. The difference between the economic life and the technical life of assets needs to be taken into account in asset management planning and financial planning.

Historical investments and asset legacy should be considered in asset and portfolio evaluations. Since past investments impose a need on future revenues, a full picture of annual cash flow demand looking forward is necessary and should be used as an adequate basis for evaluation.

Organizations should prioritise their investments by making appropriate decisions on new assets, on modifications, or on asset renewal, replacement or maintenance. As part of the asset management process, organizations should make the appropriate and correct allocation between capital expenditure and operating expenses.

6.2.2.5 Communication of the asset management plan(s)

It is critical to the successful implementation of the asset management plan(s) that the plan is appropriately communicated in a suitable format to relevant stakeholders, to meet the organization’s needs and objectives. This can include internal and external stakeholders responsible for implementation of the plan, as well as stakeholders responsible for the monitoring of the plan.

7 Support

7.1 Resources

During the development of asset management objectives and plans, the organization should determine the necessary resources that should be allocated to ensure that activities can be executed as planned.

The organization should match or map its currently available resources to its planned activities to determine any gaps. This capability gap analysis can then be used as an input to determining options for resourcing the activities (i.e. determine what you want to be capable of doing, determine the capability of the resources available to do it – the difference is the ‘gap’). This analysis applies across all asset management activities, could be extensive and can require prioritisation and programme planning of many projects to close these gaps.

In determining options for resourcing the activities, the organization should consider both internal and external sources. For human resources, options available can be affected by organizational policy and strategic plans on human resources, contracting out or outsourcing, For non-human resources, availability of resources should include consideration of procurement options (e.g. lease, hire, purchase or otherwise acquire). Both human and other resourcing needs can be influenced by the nature and duration of the activities (for example, once-of verses on-going).

In larger organizations, some activities can require other parts of the organization to provide additional resources in order to support the primary asset management activity (such as additional staff). Those responsible for implementing the asset management activity should ensure that they have coordinated effectively so that all parts of the organization are resourced appropriately.

It is possible that a resourcing analysis, for the reconciliation of available budgets with funding, could determine that not all proposed asset management activities can be resourced as proposed. An iterative process to reconcile proposed activities with available resources should be used, and the criteria and processes for prioritising asset management activities should be decided.
The provision of human resources needs to include consideration of the competencies specifically related to the activities required to be undertaken.

It is important that any tools, facilities or equipment that are required for the delivery and control of asset management activities are themselves identified and managed as assets, at a level of detail appropriate to their criticality.

7.2 Competence

To ensure resources are appropriately allocated to the asset management system, the organization should determine the necessary competencies and train people to stated competencies or take action to acquire the competency and ensure/validate ongoing levels of competency.

In the event that the organization decides to out-source any aspect of the asset management system or its asset management activities, the organization should ensure that the external resource providers can demonstrate competency against the required activities. The organization should, depending on the criticality of the activity, validate claims of competency and have in place a process to ensure that the third party resource provider continues to provide competent resources on an on-going basis. Such processes should be codified in contractual arrangements including a performance reporting and management framework for the assurance of the ongoing achievement of objectives.

The competency of resources required for the organization's asset management activities should be a fundamental input into the development of any internal human resource skills improvement and training plans, and should be reviewed periodically and updated.

Competency in asset management needs to be addressed at all levels of the organization in a way that ensures alignment between all these levels and not just for those considered to be 'asset managers'. For example, a competent trades person should be able to demonstrate clear competency in specific asset management related tasks (such as condition rating) and also have an understanding of the relationship of what they do to the asset management activities others undertake (e.g. the input of the condition rating activity into the determination of remaining useful asset life).

7.3 Awareness

The organization should establish, implement and maintain process(es) and procedure(s) to make all relevant stakeholders aware of:

a) asset management related risk consequences (actual or potential) of their work activities, their behaviour, and the asset management benefits of improved personal performance;

b) their roles and responsibilities, and the importance of their contribution in and to 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 and impact on other management processes;

c) their roles and responsibilities, and the importance of their contribution in and to the organization achieving its asset management and linked organizational objectives

d) the potential consequences of departure from specified process(es) and/or procedure(s)

e) why asset management is important to the organization

f) how well the organization is performing in meeting its objectives and how meeting its asset management objectives have contributed to overall organizational performance.

The specific awareness needs of any stakeholder should be determined by their role and its relationship to the organization meeting its asset management objectives.
The level of organizational awareness can be measured through surveys. Such surveys should focus on evaluating the following:

a) why is the asset management system important to the organization?

b) how will the implementation of the asset management system impact individuals and their roles and responsibilities?

7.4 Communication

All asset management activities carried out by the organization can need to be communicated to relevant stakeholders, at one time or another. Communications therefore need to be applied repeatedly, in a coordinated way and periodically reapplied, as an integral part of the organization's asset management (for example if you have produced an asset management plan, it needs to be communicated in some fashion). The organization should develop a communication plan that is designed to:

a) build awareness of the asset management requirements and expectations;

b) develop an understanding of how the implementation of the asset management system can impact stakeholders;

c) foster a desire amongst stakeholders to embrace and create accountability for the asset management system;

d) manage its relationship with external stakeholders and decision makers who can directly impact on the organization's activities and achievement of objectives. For example, an organization operating under the oversight of a pricing and customer service regulator, might need to communicate to its regulator evidence of its efficiency and effectiveness as part of requesting approval to increase its prices or in defence of its proposed capital expenditure programs;

e) inform and influence key stakeholders into supporting the organization's preferred asset management plans for achieving its objectives.

The communication plan should clearly define the following:

a) the reasons why the organization has elected to implement a particular activity, project, program or asset modification/augmentation;

b) the benefits of implementing an activity, project, programme or asset modification/augmentation and how these improvements are expected to collectively or individually impact stakeholders and/or the organization;

c) the improvement schedule, including key milestones; including who will be involved, and for how long;

d) any resource specific communications (i.e. maintenance, operations, engineering, supervisors, contractors, etc.) stating the asset management system expectations;

e) the who, why, when and what of communicating: including how well the organization is performing against its organizational objectives and the contribution asset management is making to this performance. The who, why, when and what could be a general approach (such as informing the community on a particular issue) but could also be targeted at key stakeholders (including both decision makers and those with influence on the decision makers) with a specific objective in mind;

f) if appropriate, what external and internal education is needed for the stakeholders to make informed contributions or decisions, or provide informed feedback;

g) the top management representative who is best suited to deliver each group communication;

h) the evaluation criteria that will be used to assess how each communication is received;
i) the feedback and reporting processes;

j) a communications schedule that is related to the asset management system objectives and plan(s).

7.5 Information support

7.5.1 General

The organization should determine the information needs pertaining to all phases of the asset life cycle through a formalised approach (e.g. information needs analysis) to ensure sustainable support of achieving organization objectives. The organization needs to be able to analyze available data; and provide the results of, and act upon, those analyses.

The organization should determine, and ensure, the availability of appropriate asset management, asset management system and asset related information (e.g. financial, risk, technical, human resource and supply chain related information), to assist in informed decision-making.

It should consider the following:

a) the information requirements should be defined to suit the level of risk that an asset poses to the organization. It should be able to supply information required for effective decision making and create a close relationship between the asset management function and supporting functions (human resource, financial, supply chain, safety, health and environment);

b) in defining the information needs all the required business processes should be mapped out and information needs for each process should be identified. The information should be of a standard to ensure that reporting can be done accurately and efficiently to the requirements of the organization to meet its obligations. A stakeholder map and reporting structure should be developed to ensure that the correct information can be made available in a timely manner;

c) effective decision making relating to asset management requires that there be a close relationship between asset managers and financial managers using a common taxonomy, so that the technical issues and risks dealt with typically by the asset managers are translated into the necessary financial information and that both work together. This requires the recognition of all lifecycle costs and expected asset performance changes associated with asset ownership to support cost-effective decision-making;

d) information should enable managers to translate their outputs into financial implications, and communicate that to the organization's financial function. Some examples where finance and asset management functions should work together include:

- agreement of asset classification and hierarchies, categories of expenditure and capitalisation rules;
- shared asset information gathering and generation;
- collective input into asset valuation processes;
- lifecycle costing analysis and costing levels of service options all feeding into multi criteria benefit analysis including both financial and non-financial criteria;
- taxonomy for use by both;
- depreciation methods, economic and technical useful lives, residual values; and
- determining any residual liabilities;

e) the information should be easily exchangeable between contracted service providers and the organization (bi-directional). The organization should design, implement and maintain systems for managing asset
management information, including configuration requirements of all asset data (functional, physical and derived). Collaboration amongst the relevant stakeholders should ensure, within management-defined limits, the completeness, accuracy and integrity of asset management information, including financial information;

f) the organization should ensure that there is a traceable link between the technical asset data inventories and the accounting records. Reporting regarding the assets should be based upon financial information linked to its technical and operational reality;

NOTE 1 Financial reporting is aimed at providing accurate and reliable information for management, statutory, regulatory, environmental, tax, insurance and financing purposes, among others.

NOTE 2 Financial information regarding assets (as recorded in the financial reporting system) needs to be based upon qualitative accounting records that reflect the technical and operational reality of the assets. The fundamental attributes of qualitative accounting records are

- completeness, as well as a system by which the assets, through identifiable and auditable accounting records, are univocally linked to the technical asset data inventories
- accuracy of the information regarding historical investment dates
- proper valuation in function of the applicable financial reporting framework
- ownership information regarding the assets.

g) the organization should implement a data registration system enabling the organization to record on a timely basis all technical and operational activities (e.g. investments, maintenance, divestments, sale of assets, asset lease) throughout the life cycle of its assets, in both the technical asset data inventories and the accounting records;

h) the information should be developed to ensure that it suits social requirements. A community affected by an organization should be approached to ensure that it gets the information relevant to its needs.

7.5.2 Financial information

Areas where finance and asset management functions work together should include:

a) agreement of asset classification and hierarchies, categories of expenditure and capitalisation rules;

b) shared asset information gathering and generation;

c) collective input into asset valuation processes; and

d) lifecycle costing analysis and costing levels of service options all feeding into multi criteria benefit analysis including both financial and non-financial criteria (see also 6.2).

7.5.3 Information attributes

The organization should define its information attributes. These attributes can be stored as metadata to give some credibility to the information being looked at. There should be a traceable link between technical asset inventory data and the accounting records. This should assist in the audit ability and traceability of information and their sources.

Effective information management is underpinned by the following principles:

- data ownership and stewardship
The organization should determine the methods for collection, analysis and evaluation, as applicable, to ensure valid results from the information available. The organization should be able to analyze available data and provide the results of those analyses, which may be via formal reports.

In determining information requirements cognisance should be taken of the complexity of the information processes. This should involve a process to develop the methods of measuring source data, the frequency of measurement, its verification, where it is stored, how it is approved before distribution and further analysis, where and how it is reworked into usable information, and how it will be communicated.

Procedures should be established, implemented and maintained for controlling information and to ensure:

a) the adequacy of the information, and that it is approved by authorized personnel prior to use;

b) it is maintained and adequacy assured through periodic review and revision, including version control where appropriate;

c) the allocation of appropriate roles, responsibilities and authorities regarding the origination, generation, capture, maintenance, assurance, transmission, rights of access, retention, archiving, and disposal of items of information;

d) obsolete information is promptly removed from all points of issue and points of use, or otherwise assured against unintended use;

e) archival information retained for legal or knowledge preservation purposes is identified;

f) information is secure and is backed up and can be recovered.

7.5.4 Information management system

The information management system should be mapped out to ensure that all the defined information requirements can be supplied. It should be able to support all the business processes identified and asset related data such as referred to in 7.6.

7.6 Documented information

The organization should determine the documentation required as being necessary to ensure effectiveness of the asset management system. Different types of documentation may address elements of the asset management system, asset management or a specific asset. The information required can differ from one organization to another and should be proportional to the complexity of the assets and the asset management system.
In establishing its asset information management system(s), the organization should consider the identification and definition of documented information that will be managed during the asset life cycle, and for a defined period beyond the disposal of assets, in accordance with the organization's requirements; this includes the legal, regulatory, statutory and other asset management requirements that are applicable to it. Examples of documented information to be considered include the following:

- user requirements
- descriptions of assets, their functions and the asset system they serve
- unique asset identification numbers
- locations of the assets, possibly using spatial referencing or geographical information systems
- the criticality of assets to the organization
- details of ownership and maintenance demarcation where assets interface across a system or network of assets
- engineering data, design parameters, and engineering drawings
- details of asset dependencies and interdependencies
- vendor data (details of the organization that supplied the asset)
- commissioning dates and data
- the condition and duty of assets
- condition and performance targets or standards
- key performance indicators
- asset related standards, process(es) and procedure(s)
- access planning and work schedules
- details of the tasks to be carried out
- work instructions together with diagrams and reporting requirements, legal obligations and safety/environmental considerations
- task risk assessments and control measures
- criteria of nonconformity and the actions to be taken
- when assets were last maintained/inspected and when these tasks are next due
- list of overdue/outstanding tasks
- historical record of planned and unplanned maintenance tasks performed
- details of historical asset failures, causes and consequences (if known)
- operational data including performance characteristics and design limits
- details of emergency plans including responsibilities and contact details
identities and levels of spares held, inter-changeability, specifications and storage locations

— financial data (including, where available, cost of historical and planned maintenance tasks, operating costs, downtime impact, current asset replacement value, original purchase cost)

— asset related contractual information.

When creating and updating documented information an organization should determine if appropriate controls are in place to ensure information is available; these controls are necessary to ensure that the personnel supporting the asset management system are using the approved, accurate, most up to date information.

Examples of the controls required are:

— review and approval process that ensures the information is correct when creating or editing documentation

— version control to ensure that the information being used is the most up to date.

Data integrity should be of the highest importance due to business or regulatory requirements. The controls put in place should be adequate for the type of information in supporting the asset management system. Simple controls such as filing cabinets can be adequate for some information, but others can require more extensive processes.

The organization should establish documented procedure(s) and operating criteria if their absence could lead to failure to achieve its asset management policy (if their absence could lead to failure or service/product delivery in a sub-optimal way), asset management strategy, asset management objectives, or to control identified asset management risks.

8 Operation

8.1 Operational planning and control

The organization should implement those processes needed to address its risks and opportunities (see clause 6 on “planning”). This should be done by establishing the criteria for risk management processes, controlling implementation of these processes based on the defined criteria, and keeping documentation that demonstrates the risk management processes have been executed as planned.

The intent of establishing risk management processes is to address both planned and unplanned changes associated with those assets that are within the scope of the asset management system. The organization should review the consequences associated with both planned and unplanned changes and take the necessary action to mitigate any foreseen adverse effects.

It is critical to the success of implementing the asset management plans that the necessary resources (particularly financial resources) are committed by the organization to achieve the planned objectives. Once the financial implications arising from the asset management system plan(s) have been quantified, linkages need to be established between the asset management system plan(s) and the financial plans of the organization, and decisions should be made jointly about financial allocations.

Processes that are outsourced to third party or contracted resources should be controlled by the organization to ensure the effectiveness of these processes, as planned.

8.2 Management of change

Changing an asset or asset management environment could change the risk profile of the organization. The asset management system should support the organization’s risk management approach; it can do so by producing as much information as possible about the organization’s assets and asset management system. The asset management system should allow the organization to plan or consider changes that affect its
assets or its asset management with sufficient time to fully consider possible impacts on the asset management objectives. Similarly, the organization should have the capability to determine emerging risks with sufficient time to fully consider their impacts on its asset management objectives.

The risk considerations should include, but are not limited to

- revised organizational structures, roles or responsibilities
- revised asset management policy, objectives or plans
- revised process(es) or procedure(s) for asset management activities
- the introduction of new assets, asset systems or technology
- applicable supply chain factors
- market demands and response
- the introduction of new contractors or suppliers.

The organization should have the capability to make evidence-based decisions on proposed changes and the ability to consider scenarios systematically across the entire organization. Risk scenarios should be visible and be accessible across the entire enterprise.

EXAMPLE A power generation company is considering the ways it can address the growing cost of operating power generation units that burn coal. The asset management system allows the organization to determine the parts of the fleet where the operational cost is the highest. The asset management system produces data regarding cost, age, design, operation, replacement power cost, etc. The system allows the company to consider multiple scenarios regarding the condition of its assets, what needs to be done to it, when it needs to be done, and the overall investment needed. The organization can systematically consider the risks and consequences of: making repairs (what and how); complete replacement of assets; or of not making any changes at all. The organization would then be in a position to base its decisions on how they might affect its ability to deliver on organizational objectives, e.g. regarding its customers, reputation, sustainability, etc.

8.3 Outsourcing of asset management activities

When an organization chooses to outsource aspects of asset management, the organization should document and control such activities, in order to prevent nonconformity with the organization's objectives and stated stakeholder expectations.

The organization should define the outsourced processes and activities as well as agree the appropriate means to measure their performance or level of service provided. The scope of the outsourced activities should be aligned with the general objectives by which the asset is to be managed.

The organization should communicate and document the organization's requirements relating to its operating environment, business practices and requirements. For example, this may include the organizations legal, operational, security, safety and reputational requirements. The organization should also ensure that it identifies the appropriate individuals or groups who will be responsible for managing its outsourced activities.

The performance achieved of the activities that have been outsourced should be reported to relevant stakeholders (see clause 7).

The outsourced activities should also fulfil the requirements regarding continuous improvement (see clause 10).
9 Performance evaluation

9.1 Monitoring, measurement, analysis and evaluation

Monitoring, measurement, analysis and evaluation cover some of the most complex and important areas which need to be addressed by an asset management system. They include consideration of the different analytical techniques which can be used, and the types of reports which should be produced for use by management and other stakeholders.

The inputs to determining the appropriate monitoring, measurement, analysis and evaluation elements of the asset management system are determined by careful analysis of how performance visibility is to be achieved, covering all aspects of the asset management system, the asset management processes and the assets, as covered by ISO 55001. The appropriate monitoring, measurement, analysis and evaluation elements need to be clearly defined in the asset management system.

In many cases (and particularly for highly regulated industries or public sector organizations) multiple legal and regulatory requirements relating to monitoring, measurement, analysis and evaluation have to be considered, properly understood, and fully adhered to.

The outcome of performance evaluation should be the availability of appropriate information of high integrity to facilitate sound decision-making.

One specific example outcome is a defined list of cascading performance indicators. Such a list of cascading performance indicators should also contain clear guidelines as to the grouping, summarizing, presentation and frequency of information, according to organizational segmentation, geographic spread, specific responsibility and accountability for the various elements of the asset management system, as well as the assets.

A clear understanding of the underlying business functions together with the responsibility and accountability for these provides a good starting point for developing a set of suitable performance indicators. It also provides a good starting point for determining the required frequency for reporting the information involved.

EXAMPLE The formal reporting of asset availability on a per-shift basis might be a requirement for supervisory staff, but the same information might only be required by management staff on a daily or weekly basis.

Particular care needs to be taken to ensure that reported information has the same meaning to all recipients who receive it. Practical considerations in this regard are:

a) a formal, controlled dictionary of terms which covers the terminology used in the performance reporting system should be available and adhered to. Such dictionaries need to adhere to the definitions contained in ISO 55000; as well as other recognized dictionaries;

b) a common taxonomy between the engineering and financial disciplines often needs special consideration. Because cost plays such an important role in reflecting asset-related performance, the common taxonomy should at least provide for a shared set of classification systems, a common understanding of formal roll-up structures, and a common understanding of how asset portfolios, asset systems and individual assets are broken down for lifecycle management purposes. A joint policy-style document which explains the joint cost model, and which is clearly cross-referenced to the relevant elements of the asset management system can go a long way to achieve a common understanding between the engineering and financial disciplines. Reports should indicate the scope, for example that only specific objects or groupings are covered by it;

c) reports should include an indication of the sensitivity of the information included within them, as well as the various control requirements that they might be subject to.

The change in future value of the assets and the risk profile of that future value should be evaluated in terms of both a financial context (including: net present value, internal rate of return, and payback) and a non-financial context (including health, safety, environmental, social and reputational affects). The management system should include a mechanism to make such evaluations through a consistent process and methodology, either through policy for simpler decisions or by using a multi-criteria decision making methodology for more
complex and higher consequence decisions. The evaluation methodology should be developed at the
business level and include a multi-disciplined team consisting of financial, legal, purchasing and technical
representatives.

Reporting on the asset management performance should extend beyond information that might be available
through financial reporting as required by IFRS and GAAP. Additional information in the periodic reporting
regarding financial-technical and operational information on assets should inform stakeholders on the way the
assets are being managed. This is of particular importance in the case of capital-intensive organizations
where these assets constitute a substantial portion of the total balance sheet value.

Additional information in the periodic reporting on financial-technical and operational aspects of asset
performance can increase the comprehensibility, relevance, reliability and comparability of the financial
statements.

Transparency is vital as part of the asset management system. This requires adequate information about the
organization's assets, its asset management and its ability to manage assets effectively, efficiently and
reliably. Transparency helps stakeholders understand the asset management objectives of the organization.
They can influence these objectives in a positive way by giving their thoughts on how the organization should
conduct business.

The periodic report is an important means of communicating with stakeholders. Apart from the traditional
financial reporting, this report should include more information on how the organization has structured and
developed policy and procedures to meet the requirements of good asset management.

The level of detail of the information included in the periodic report will vary from one organization to another
depending on the complexity of its activities and on the complexity of the assets it manages. This scalability
has to be taken into account when dealing with the transparency requirement.

Transparency does not mean that the organization has to disclose confidential information.

The reporting on assets should be based upon financial information linked to the organization's technical and
operational data registers. Key aspects regarding an adequate data registration process are:

--- a uniform technical, operational and financial glossary;
--- a technical, operational and financial registration, which is interrelated and linked to the assets or their
components;
--- adequate and accurate information of technical and operational events that have a potential impact on
financial reporting.

This monitoring in the financial reporting system should be done at a level of detail or granularity suitable for
the complexity and value of the assets and their components. When appropriate, assets should be split into
components by means of an asset breakdown structure taking into account

--- the significance of the value of the components in relation to the asset
--- the possibility of a different technical and financial lifespan for components.

The process(es) and procedure(s) for assets, asset systems and the asset management system, should
provide for the consideration of:

a) reactive monitoring, to determine past or existing nonconformities in the asset management system, and
any asset-related deterioration, failures or incidents;

b) proactive monitoring, to seek assurance that the asset management system and assets and/or asset
systems are operating as intended. This should include monitoring of indicators to ascertain that the asset
management policy, strategy and objectives are met, the asset management plan(s) are implemented,
and that the process(es), procedure(s) or other arrangements to control asset life cycle activities are
effective;

c) leading performance indicators, to provide warning of potential non-compliance with the performance requirements of the asset management system and/or the assets and/or asset systems;

d) lagging (retrospective) performance indicators, to enable detection of, and to provide data about, incidents and failures of the asset management system, and for incidents, failures or deficient performance of assets and/or asset systems;

e) both qualitative and quantitative measures, appropriate to the needs of the organization;

f) recording of monitoring and measurement data and results, to facilitate subsequent analysis of problem causes to assist in determining corrective actions and to facilitate continual improvement (see 10.2).

When setting the frequency of condition or performance monitoring and the parameters for measurement the organization should consider, at a minimum, the costs of monitoring, the risks of failure or nonconformity, and potential deterioration mechanisms and deterioration rates.

Reactive monitoring comprises structured responses to an indication of a deficiency or failure of the asset management system, asset management or assets. This indication could be the failure of an asset, or assets failing to perform as expected, or it could be evidence that the asset management system itself is deficient, for example, as a result of an observation from an external party, such as a regulatory agency.

Proactive monitoring comprises timely routine and periodic checks that plans and planned arrangements have been implemented, to determine the level of conformance with asset management system requirements and to seek evidence of problems with the asset management system, asset management or assets that have not otherwise come to the attention of the organization via reactive monitoring.

Performance and condition measurement and monitoring focuses on the performance of the asset management system (i.e. processes) and the performance and/or condition of the assets or asset systems on a day-to-day basis, retrospectively (normally based on an annual plan). The two should not be confused.

Proactive monitoring should be carried out to determine whether:

a) the asset management system is being operated as intended, i.e. asset management objectives, targets and plans have been set and are achieved

b) the assets are functioning as required, i.e. the output, reliability, availability, condition, etc. from an asset are as planned

c) asset management plans, operational control criteria and applicable legislation, regulatory, statutory, and other asset management requirements are being complied with. An exclusive reliance on reactive monitoring could lead to complacency, with the organization’s asset management system likely to lie dormant until problems occur. Proactive monitoring of asset management performance in many cases (for example where routine checks are carried out) leads to immediate corrective action and the information about the findings might not be formally recorded. Where practicable, organizations should record the findings of such proactive monitoring (and actions resulting) and should always document the findings of reactive monitoring (and actions resulting).

Organizations should base their performance measurement on a well-formulated combination of objective, subjective, quantitative and qualitative data types:

a) objective data: data which is detached from an assessor’s personal judgement;

b) subjective data: data which could have been influenced by those doing the measuring. These measures can be very useful but need to be treated with care;
c) quantitative data: data which describes numbers and recorded on a scale. Where possible, it is desirable to quantify performance measures so that comparisons can be made over time. However, such data might give an unjustified impression of precision;

d) qualitative data: data which describes conditions or situations that cannot be recorded numerically. While qualitative data is very important it might be difficult to relate to other performance measures.

To ensure completeness, accuracy and integrity of management information should be part of the performance assessment process that allows the organization to review the usefulness of information that it needs to have available, to better prioritize its financial allocations and be satisfied that it is able to make decisions that take into account all relevant information.

9.2 Internal audit

Audits should support learning and improvement of the asset management system. To achieve this, the audits should focus on the performance of the asset management processes as opposed to the performance of persons within the processes. Attention should be paid to examples of good/best practice and improvement opportunities. At the same time, audits should also determine system deficiencies, checking conformity of practice and the asset management system with each other, and with the requirements of ISO 55001. Audits should as much as possible be “part of doing business”, being a routine part of working practice that interrupts working processes as little as possible, and providing improvement suggestions that are value adding and achievable.

Self-assessment is another instrument that can be helpful in driving continual improvement. Self-assessments are generally broader in scope than audits. Typically a self-assessment is conducted by the management team of the organization, supported by staff. An example of a self-assessment could be a mapping of the organization’s actual and desired/future performance and characteristics against the recommendations and guidance of this International Standard. The difference between these could be recorded in a gap analysis. This gap analysis could then be used to draw up an improvement plan or agenda.

Auditing is a process whereby organizations can review and continuously evaluate the effectiveness of their asset management system.

An audit should determine any corrective actions required to achieve compliance with the requirements.

The audit should include assessing and determining the viability and suitability of the asset management policy, objectives and plans, particularly in relation to critical assets and asset systems, to ensure that they are

— consistent with each other,
— adequate,
— achievable.

Establishing whether they are adequate and achievable also requires assessment of the organization’s

— asset management related assumptions,
— process(es) and/or procedure(s), methods, tools and techniques,
— availability/allocation of funds,
— availability/allocation of resources (including competencies),
— availability/allocation of time (including timing interdependencies).

The general principles and methodology described in ISO 19011 are appropriate for asset management system auditing.
Audits should provide comprehensive coverage of the whole asset management system. This could require auditors with different expertise to contribute to the different elements. It can be appropriate to use a combination of audits to get the necessary depth and coverage, taking either:

a) a “horizontal slice”: for example, an audit of asset management plan(s) across the organization to verify that the plans conform to the relevant requirements in ISO 55001; or

b) a “vertical slice”: for example, the arrangements to manage a specific asset over its life cycle, or a specific asset-related risk, are audited in terms of the asset management policy and asset management plan(s), the enabling and control processes (including risk management), implementation of asset management plan(s), performance monitoring and management review.

In deciding the scope of the audit, it is good practice to consider the risk associated with both the asset management system and the assets. This can aid the relevance of the audit, and can directly contribute to objective re-assessment of the risk areas.

The competence of the auditors, taking the nature of the “slices” to be covered, needs special consideration, as objectivity and impartiality are fundamental requirements. As a general guideline, auditors should not audit any aspect of their own work area or area of responsibility.

The audit process should look for changes in business and asset operating context that renders stated procedures and processes invalid, thereby introducing risk. The results of previous audits as well as management reviews should therefore be considered as well during the audit process.

The audit process should encourage auditors to determine opportunities for continual improvement. Active participation, understanding and support of the organization’s employees are important in achieving this.

The audit results should be used as inputs for corrective action and continual improvement.

9.3 Management review

Top management should review the operation of the asset management system to assess whether it is being fully implemented correctly and being fully used, and whether it remains suitable for achieving the organization’s stated asset management policy, objectives and plans.

The review should also consider whether the asset management policy continues to be appropriate for the organization’s purpose. It should establish new or updated asset management objectives for continual improvement, appropriate to the coming period, and consider whether changes are needed to any elements of the asset management system.

Reviews should be carried out by top management on a regular basis, for example annually. The review should focus on the overall performance of the asset management system and not on specific details, since these should be handled by the normal means within the asset management system.

Reviews should include assessing the need for changes to the asset management system, including asset management policy and asset management objectives. Inputs to management reviews should include:

a) the results of internal audits and evaluations of compliance with applicable legal requirements and with other requirements to which the organization subscribes;

b) the results of communication, participation and consultation with employees and other stakeholders;

c) relevant communication(s) from external stakeholders, including complaints;

d) records or reports on the asset management performance of the organization;

e) the extent to which objectives have been met;
f) performance in addressing incident investigations, corrective actions and preventive actions;

g) changing circumstances, including developments in legal and other requirements related to asset management, changes in technology and changes in market requirements.

The management review should also cover aspects of the asset management system, if any, that are outsourced to a contracted service provider.

The outputs from management reviews should include decisions and actions relating to:

— asset management policy and objectives;
— asset management performance requirements;
— resources;
— other elements of the asset management system.

Outputs from management reviews, which are relevant to the organizational strategic plan, should be made available to top management for consideration in reviews of the organizational strategic plan.

Information relevant to specific employees, contracted service providers or other stakeholders should be made available for communication purposes.

10 Improvement

10.1 Nonconformity and corrective action

10.1.1 General

The organization should be aware of the fact that nonconformities will occur in assets, asset management and asset management systems and, as such, should determine how the organization plans to handle nonconformities and their associated consequences, to minimize adverse effects on the organization and stakeholder needs and expectations. This can be accomplished by documenting past nonconformities, how the consequences were dealt with, and methodologies to prevent future nonconformity. The organization can also determine corrective actions to address nonconformities within the asset management system through internal audits.

Corrective actions are actions taken to address the root cause(s) of identified non-conformances, or incidents, in order to repair, manage consequences and to prevent, or reduce the likelihood of recurrence. Aspects to be considered in establishing and maintaining corrective action procedures include:

a) the identification and implementation of corrective measures both for the short-term as well as the long-term (this can also include the use of appropriate sources of information, such as advice from employees with asset management expertise);

b) the evaluation of any impact on risk identification and assessment results (and any need to update risk identification, assessment and control report(s));

c) the initiation and implementation of corrective action;

d) the recording of any required changes in procedures resulting from the corrective action or risk identification, assessment and control, and implementation of these changes.
10.1.2 Processes for investigation of asset-related failures, incidents and nonconformities

The organization should establish, implement and maintain process(es) and procedure(s) for the handling and investigation of failures, incidents and nonconformities associated with assets, asset systems and the asset management system. These process(es) and procedure(s) should define responsibility and authority for:

a) taking action to mitigate consequences arising from a failure, incident or nonconformity;

b) investigating failures, incidents and nonconformities, to determine their cause(s);

c) evaluating the need for preventive action(s), to avoid failures, incidents and nonconformities occurring;

d) communicating, as appropriate, to relevant stakeholders the results of investigations and identified corrective action(s) and preventive action(s);

e) performing investigations within a timescale commensurate with the actual and potential consequences of the failure, incident or nonconformity.

The organization should establish, implement and maintain process(es) and procedure(s) for instigating:

a) corrective action(s) for eliminating the causes of observed poor performance and nonconformities identified from investigations, evaluations of compliance and audits, to avoid their recurrence;

b) preventive action(s) for eliminating the potential causes of nonconformities or poor performance.

Any corrective or preventive actions taken and their timings should be commensurate with the risk(s) encountered.

Where a corrective or preventive action identifies new or changed risks, or the need for new or changed process(es), procedure(s) or other arrangements to control asset life cycle activities, the proposed actions should be risk assessed prior to implementation.

The organization should monitor the timely close-out/completion of the corrective action(s).

The organization should keep records of the corrective and preventive actions taken and communicate these to relevant stakeholders.

The organization should ensure that any necessary changes arising from corrective and preventive actions are made to the asset management system.

10.2 Continual improvement

Preventive actions are those taken to address the root cause(s) of potential non-conformances or incidents, as a proactive measure, before such incidents occur. Examples of elements to be considered in establishing and maintaining preventive action procedures include:

a) the use of appropriate sources of information, e.g. trends in asset performance indicating imminent risk of failure, failure rates across a population of assets, revised risk assessments, data on environmental changes

b) the identification of any potential problems requiring preventive action

c) the use of an appropriate methodology to select a suitable and sufficient preventive action

d) the initiation and implementation of preventive action

e) the recording of any changes in procedures resulting from the preventive action.
Opportunities to improve should be identified, assessed and implemented across the organization as appropriate, through a combination of monitoring and corrective actions for the assets or asset management system. Continual improvement should be regarded as an iterative activity, with the ultimate aim to be to deliver the organizational objectives. It should not be interpreted as cyclic (e.g. annual) improvement in asset performance parameters just because they can be achieved.

The organization should establish, implement and maintain process(es) and procedure(s) for determining opportunities and assessing, prioritizing and implementing actions to achieve continual improvement.

The organization should actively seek and acquire knowledge about new asset management-related technology and practices, including new tools and techniques, and these should be evaluated to establish their potential benefit to the organization.

10.3 Preventive and predictive actions

Only responding to evidence of non-conformity through backward looking processes such as audit, review or post event evaluation (such as investigation of an accident or failure), while essential, is not good asset or risk management unless it is accompanied by consideration of preventive and predictive actions.

Preventive actions are those taken to address the root cause(s) of potential non-conformances or incidents, as a proactive measure, before such incidents occur. Examples of elements to be considered in establishing and maintaining preventive action procedures include:

a) the use of appropriate sources of information, e.g. trends in asset performance indicating imminent risk of failure, failure rates across a population of assets, revised risk assessments, data on environmental changes

b) the identification of any potential problems requiring preventive action

c) the use of an appropriate methodology to select a suitable and sufficient preventive action

d) the initiation and implementation of preventive action

e) the recording of any changes in procedures resulting from the preventive action.

Minimising the potential and consequence of failure by undertaking preventive or pro-active activities is essential. Design, for example, of a maintenance strategic plan considers the efficient and effective balance of preventive, predictive and corrective maintenance activities.

An organization could go through a formal process of determining leading indicators or performance measures of potential failure (such as condition monitoring programs or periodic customer surveys of perception of performance. The organization could then set targets or trigger points for action to be taken and forecast when that point will be reached. The identification of trigger points should consider:

— absolute values (for example; we do not want customer satisfaction to fall below 80%)

— the trend in deterioration (for example; customer satisfaction is falling at 5% per year)

— the change in the trend in deterioration (for example; the change in performance is getting larger each year, so the non-conformity will occur earlier than we expected).

The processes of determining performance measures, trigger points and preventive and predictive actions is a fundamental input to the asset management planning process and overlaps with the risk management process.

One key activity that also needs to be addressed is to ensure that all measurement tools, equipment or methodologies used in the delivery and control of assets or asset management activities have been (periodically) calibrated, tested or validated, as appropriate, and any required adjustments made, so that the information they provide is correct or valid.
The organization should establish and maintain process(es) and procedure(s) to control these maintenance, calibration or adjustment activities, where such tools, equipment or methodologies are essential for:

a) the implementation of its asset management plan(s);

b) achieving the required function(s) and performance from its assets or asset systems;

c) the monitoring and measurement of performance and condition;

d) the fulfilment of regulatory reporting obligations;

e) as a record or evidence in the event of failure.

Monitoring equipment or instrumentation can be built into an asset and can also require periodic calibration, adjustment or testing; this should be regarded as an intrinsic need of the asset itself, to be determined, planned and controlled appropriately.
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