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Asset management — Guidance on the management of data assets

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 251, *Asset management*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

This document gives guidance on the management of data when applying asset management principles or requirements for an asset management system. These principles and requirements are described in ISO 55000 and ISO 55001, respectively. Much of asset management involves decision-making with decisions being reliant on data, particularly for larger and more complex contexts.

This document is intended to facilitate organizations in their management of data in the context of asset management. Effective asset management typically relies on the proper management of data that is pertinent to the assets. Organizations can manage the data as an asset to support their organizational management. This document covers management of data both for supporting the practice of asset management and for handling the data as an asset.

NOTE For the purposes of this document, the term "asset data" is used to refer to data that lists and describes an asset and the term "data asset" is used to refer to collections of asset data that has the properties of an asset.

This document gives guidance for those who:

a) are identifying the usefulness or fitness for purpose of data for achieving the asset management objectives of the organization, including fulfilling its accountability;

b) are involved in the establishment, implementation, maintenance, stewardship and improvement of data in the context of asset management;

c) are involved in the planning, designing, implementation and reviewing of data-based asset management activities along with service providers;

d) are asset owners, asset managers, information managers, service providers, maintainers, partners, auditors, regulators and investors;

e) are the internal and external stakeholders, including internal and external personnel, that affect, or are affected (positively or negatively) by, the management of data in the context of asset management.

Management of data can play a critical role in other management systems as well as in an asset management system. Meanwhile, there can be many benefits for organizations to integrate and implement multiple management systems. The achievement of mutual alignments to other management systems requires an approach based on an appropriate cross-functional data exchange and analysis within the organization.

0.2 Context of this document

Against a background of advances in information technology (IT) and diversifying stakeholder demands, how data should be managed in the context of asset management is now seen as a pressing issue for many organizations. As organizations get larger and tend to become more complex, the need for reliable data to support sound decision-making becomes increasingly important. Data acquisition and maintenance is a cost to an organization, while data's potential value is realized when it is used or can be used in the future. The value of data is diminished if it is unreliable, out of date and/or applied incorrectly.

Accordingly, the role of data is changing from being a resource that supports management activities to a non-physical asset from which value is generated by being managed in a coordinated way, just like any other tangible or intangible asset.

Data in the context of asset management has its own characteristics as follows:

a) like physical assets, asset data follows a sequence of life cycle stages; it can be used many times although the usefulness of data can change as they move along their life cycle;

b) data can be stolen if not protected appropriately; such data theft does not bring data loss and can therefore not be immediately evident to an organization yet create sustained negative impacts;

c) data are easy to copy, transport and even corrupt, but they can be difficult or impossible to reproduce if they are lost, destroyed or corrupted;

d) data can be used for multiple purposes: the same data can even be used by multiple people at the same time; similarly, many people and processes can be adding or updating data simultaneously;

e) data can generate new value when combined with other assets;

f) many uses of data often lead to more data to handle as a result; most organizations manage increasing volumes of data and the relationships between data sets;

g) data and information are essential in conducting business within an organization and/or between two functions or divisions; most business decisions from the strategic to the operational level generally involve the sharing of data.

While some of these characteristics are similar to other assets, as a whole, they differ in nature from those of other asset types. This requires different approaches to ensure that the management of data supports its objectives in the context of asset management.

Different data sets may be treated as assets which can be critical to the success of the organization. In such situations, organizations may treat such collections of data as data assets. The principles of asset management described in ISO 55000 should be applied to the management of data assets.

0.3 Relationship to ISO 55000 and ISO 55001

ISO 55000 is the foundation for implementing asset management, and therefore the prerequisite to understand this document.

ISO 55001 can be applied by organizations to establish and implement an asset management system. This also applies to an asset management system for data assets. On the other hand, since an organization's asset management system is supported by decision-making based on information or data and its analysis, the process of determining decision-making criteria in an asset management system that meets the requirements of ISO 55001 generally includes the process of managing data. As such, this document facilitates organizations to include data assets within their asset management system.

Asset management — Guidance on the management of data assets

1 Scope

This document gives guidance on managing data to support an organization in meeting its asset management objectives and by extension its organizational objectives.

This document is applicable to any organization, regardless of its type or size.

This document does not provide methodologies to derive or appraise value for data assets.

This document does not provide methodologies to derive financial values for data assets.

This document does not provide direction to organizations on the need (or not) for calculating financial values for asset data.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Asset management — Vocabulary, overview and principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 55000 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
asset data
data that lists and describes an asset

Note 1 to entry: Asset data can exist in a number of formats such as structured data, documented information, sensor data, etc. requiring different approaches to their management.

Note 2 to entry: Data supporting asset management decision-making can be considered as asset data.

3.2
data asset
data that has the properties of an asset

Note 1 to entry: Data assets can be managed as an asset in accordance with ISO 55001.

Note 2 to entry: *Asset data* (3.1) can be part of more than one data asset. Data assets can have relationships between each other.

3.3
type
data type
named category of data characterized by a set of values, a syntax for denoting these values, and a set of operations that interpret, manipulate or store the values

[SOURCE: ISO/IEC 1539-1:2023, 3.144, modified — "or store" added.]

3.4
metadata
data that defines and describes other data

[SOURCE: ISO 24531:2013, 4.32]

3.5
data quality
degree to which a set of inherent characteristics of data fulfils requirements

[SOURCE: ISO 8000-2:2022, 3.8.1, modified — Note to entry deleted.]

3.6
interoperability
capability of two or more entities to exchange items in accordance with a set of rules and mechanisms implemented by an interface in each entity, in order to perform their specified tasks

Note 1 to entry: Examples of entities include devices, equipment, machines, people, processes, applications, computer firmware and application software units, data exchange systems and enterprises.

Note 2 to entry: Examples of items include services, information, material in standards, design documents and drawings, improvement projects, energy reduction programs, control activities, asset description and ideas.

Note 3 to entry: In this context, entities provide items to, and accept items from, other entities, and they use the items exchanged in this way to enable them to operate effectively together.

[SOURCE: ISO 18435-1:2009, 3.12, modified — "specified" replaced "respective" in the definition. Notes 1 and 2 to entry expanded. Note 3 to entry added.]

3.7
governing function
function responsible for the strategic guidance of the data governance programme

Note 1 to entry: The governing function is responsible for the prioritization of data governance projects and initiatives, and the approval of organization-wide data policies and standards, as well as enabling ongoing support, understanding and awareness of the data governance programme.

Note 2 to entry: Depending on the culture of the organization, a governing body can be known by other names such as the data governance committee, data governance steering council/committee/group, data governance advisory council/committee/group, data stewardship council/committee, data owners' council/committee.

4 Managing asset data

4.1 General

Asset management enables an organization to realize value from its assets in the achievement of its asset management objectives and by extension its organizational objectives. What constitutes value depends on these objectives, the nature and purpose of the organization, and the needs and expectations of its stakeholders (see ISO 55000).

Many asset management activities rely on effective decision-making which in turn relies on data and documented information. The asset data used by an organization to inform decision-making in turn requires effective management to ensure usefulness to the organization within the required timescales. Suitable accountability and management of these asset data is required to ensure and maintain usefulness.

Asset data can be created, acquired or generated at all stages of the asset life cycle. Asset data supporting asset management activities is generally required for at least as long as the asset itself exists. Asset data that conformed with the requirements of the organization at the time it was acquired does not necessarily conform to current organizational requirements.

The configuration or nature of the asset can constrain or prevent data acquisition activities and also make it difficult to check or improve incorrect or missing asset data. Asset interventions occur at a discrete period; therefore, subsequent checking or improvement of asset data arising from these interventions requires additional data sources.

4.2 Asset data

4.2.1 Data requirements

The organization should determine its data requirements and manage its data across its life cycle to support the scope of its asset management system to achieve both its asset management and organizational objectives (see ISO 55001:2024, 7.6, which also deals with requirements related both to the data themselves and to their alignment across the organization's functions).

In addition, the organization should determine the following:

a) Legal requirements: The legal requirements of holding, managing and transferring asset data.

b) Data dictionaries: Data specifications and requirements by the organization's management system to enable consistent definition of attributes, units of measurement, criticality, quality and source for the different types of asset data.

c) Data frequency: The frequency for updating data. While some asset data can remain static across all life cycle stages, others can be updated in pre-defined intervals of time.

d) Data volume: The volume of data can determine which tools and storage environments are most appropriate to be used.

e) Data security: Ensuring that data are protected from inappropriate access (e.g. from loss of confidentiality, improper use or improper modification including improper additions, alterations and deletions).

f) Data availability: Ensuring the availability of data at critical times is defined and it is accessible by the asset management team when required.

g) Data responsibility: Determining roles and responsibilities related to the management of asset data.

Where it is not possible for the organization to achieve these data requirements, it is important for the organization to provide direction as appropriate.

Before data can be published or used to make asset management decisions, its quality should be understood. Making decision-makers aware of what data are available and how their quality enables informed decision-making, mitigates risks related to confidence in the accuracy and effectiveness of the decisions being made.

By deriving meaning from data and by managing data to ensure that they are of sufficient quality to meet asset management objectives, they increase in usefulness to the organization.

Quality requirements for asset data closely relate to asset data requirements. Quality requirements are determined and managed alongside the data requirements to ensure an adequate balance of cost, risk and performance. Data quality can be assessed using a confidence scale similar to that of the condition scale of the underlying asset.

NOTE The ISO 8000 series provides guidance on assessing and managing data quality.

The identification of data requirements and associated quality requirements ensures that data are fit for purpose and provides support to decision-making processes as expected.

4.2.2 Processes for collection, analysis and evaluation

Changes to assets and the acquisition or disposal of assets generates asset data requiring collection and storage for future use and decision-making. Defined processes covering such situations supports the consistent collection and analysis of asset data.

4.2.3 Processes for management

Changes to assets, software technologies, processes and organizational configurations will generally lead to related changes to asset data. Defining and running processes for all aspects of the asset data life cycle ensure that asset data continues to support asset management decision-making.

The processes for the management of asset data should include a consideration of ongoing maintenance from the decision to collect data. Without processes for maintaining data quality, the results of the initial data collection exercise can quickly lose value. As soon as data are collected, data quality management should become part of the normal business processes.

NOTE ISO 8000-61 describes a process reference model for data quality management.

4.2.4 Alignment of terminology

Different organizational contexts, technical disciplines, software technologies and territories can lead to differences in the terminology relating to assets. Data dictionaries can be useful to explain synonyms and different terminology and to clearly identify preferred terms.

4.2.5 Consistency and traceability

Asset data supporting the asset management objectives of an organization can arise from many sources and processes, potentially leading to inconsistent approaches to collection and storage. Asset data can be transferred between data stores, potentially multiple times, with each transfer activity potentially being a source of inconsistency or quality issues.

Management processes to monitor the consistency of asset data helps identify activities leading to inconsistent data. Asset-owning organizations typically have data about assets stored in more than one data store. Where this is the case, one data store should be identified as the master data source that is updated first and is referred to by other data stores. Understanding how data are transferred into, across and out of an organization ensures that master data sources are understood and that changes to master data are correctly applied across the organization.

4.3 Documented information

4.3.1 General

Documented information can fulfil many purposes within an organization, including recording and explaining the asset management system, providing narrative descriptions of how to maintain an asset and providing test certificates. Like asset data, documented information can experience many similar problems and requires active management.

4.3.2 Identification and description

Organizations typically acquire and store large quantities of documented information. Documented information can support ongoing processes and decision-making or can require safe storage for future usage, for example, during asset disposal.

Defined and relevant approaches to the identification and description of documented information ensure that people can find the correct documented information without undue effort.

4.3.3 Format

Documented information may have many different arrangements and formats of the content within them and may be stored using different file formats. Organizations that specify allowable content and file formats help ensure that users of the documented information can effectively do so for as long as the information is needed to support asset management decision-making.

4.3.4 Suitability and adequacy

Documented information may be created in many different written styles, use varied content structures and can have very different quantities of text, to meet the needs of different use(s) and users. Assessing the suitability of documented information against these use(s) and users helps ensure that asset decision-making is effectively supported and ensures documented information meets organizational requirements. Assessments of the adequacy of documented information against the use(s) and users identifies where revisions and changes to the documented information are required.

NOTE Where organizations operate in multiple countries or use different languages, the language used can be an additional factor relating to suitability.

4.3.5 Ensuring availability

Many factors can restrict the availability and suitability of documented information, including:

a) changes to technology platforms increasing or decreasing the availability of documented information (e.g. changes in the capability and effectiveness of search functionality);

b) changes to software licensing, which can restrict user access to required documented information;

c) changes to the user base within the organization, such as when expanding into new territories, which can necessitate the translation of documented information into different languages;

d) changes to the competence of users within the organization (e.g. which can necessitate the redrafting of documented information into simpler formats for users with lower competency levels).

4.3.6 Protection of documented information

Documented information can be required over the whole life of the assets that they represent. Factors that inform the level of protection required include the following:

a) Protection from deletion: Application of user-level permissions to restrict who may delete documented information. The deletion may also include logical deletion prior to ultimate physical deletion.

b) Protection from alteration: Application of user-level permissions to restrict who may edit and alter documented information. The retention of superseded versions of documented information allows organizations to view and restore previous versions of the documented information.

c) Protection of unauthorized access: Application of security permissions to restrict access to documented information to approved users within the organization accessing, sharing or printing restricted information. Security permissions and restrictions on document sharing can protect documented information from unauthorized users outside the organization.

d) Protection from technology failure: Application of data backup processes to maintain off-line and off-site copies of documented information that may be used to restore documented information in situations of catastrophic hardware and/or software failure. Testing of backup restoration processes ensures that backups are being correctly taken and that there are the skills and tools to restore this documented information.

4.4 Data life cycle stages

4.4.1 General

The accountability for data and its use ultimately rests with the governance function of the organization, and is usually delegated to those responsible for the operation of the asset management system. These life cycle stages may be applied in a different order, and depending on the organizational context, can have different relationships to each other.

NOTE Annex A provides supplementary information/explanation on data life cycles.

4.4.2 Define

The define activity includes provision of explicit guidance of the form, structure and meaning of asset data required by the organization. The combined set of data definitions for an organization may be described as a "data dictionary", "organizational information requirements" (OIR) or "asset information requirements" (AIR).

The overall collection of data definitions for an organization changes over time. The organization's change management processes should ensure that changes are agreed before implementation.

4.4.3 Collect

The collect activity includes the data acquisition, gathering and creation process, learning from previous decisions made, and additional context extracted from other data sets (internal or external).

Data exists in many forms and can be created and collected for managing by individuals in the organization in a number of different ways, including the following.

a) Data entry: Data entry is achieved using applications either within the organization (e.g. in an enterprise resource planning, enterprise resource planning (ERP), system or email application) or externally via a website, mobile application or similar application.

b) Transactions from other systems: Data entry or updating done on other systems can flow through to the organization's system through electronic data interchange (EDI), or other interfacing processes.

c) Sensors: An increasing amount of data are ingested into the organization through machine systems such as sensors. Sensors cover a wide range of data acquisition devices including website logs, social media sources and so-called "internet of things" devices which include everyday devices from simple temperature sensors to TVs, cars, traffic lights and buildings. Data from sensors can also include potentially urgent signals such as alerts and alarms.

d) New context: Data from reports can be combined with other data sources, such as from supplementary models, to provide additional information, which is itself fed back into the data of the organization. In many cases, this additional data gives new context to the original data and should be treated differently from the original data. New contextual data may come from decisions which can give relevance or value to existing data.

e) Subscription: Data may be made available to the organization through a subscription to a data feed or virtual data store.

f) Time sensitivity: Live data can encounter an expiry date, or data collected at any given time can be required and useful only at certain times. Therefore, the time frame of the data collection and the relevance of the data for that moment in time should be considered during this life cycle stage.

4.4.4 Store

The store activity includes locating the data where it can be retrieved. This includes data stored on devices owned and operated by the organization, devices external to the organization and also virtual stores, such as data feeds where the data are only collated when needed. In each case, the stored data may be retained for reporting purposes pending a decision to dispose.

As data are collected through the above actions, it is ingested into a data store where it should be secured, managed and possibly archived. The amount of data that organizations control is increasing rapidly due to new technologies. Many of these new technologies run in public cloud computing environments where the economies of scale enable large storage and processing capabilities at much lower cost.

In some cases, the organization may use a data store that is outside its location. Traditionally, this has been through offsite hosting operations where the storage is outsourced. Cloud computing takes this to the next stage where the operation of the store is not visible to the client organization. Furthermore, the organization may use a virtual store, where data are provided only as a data feed which can flow directly into reports or analysis.

Even though the organization controls the data in its store, it does not necessarily own that data because of intellectual property rights (such as copyright) or other legal issues (including personal or health information handling laws). Special care may also be necessary where the storage and use of data cross jurisdictional boundaries. In any case, the stewardship of the data remains with the governance function.

NOTE ISO/IEC 27040 provides guidance on data storage security.

4.4.5 Reporting

The reporting activity includes the manual or automated extraction and analysis of data to support decision-making, distribution or disposal. It is important to note that the reporting and deciding activities can be interchangeable in their order, as they have a bidirectional relationship.

An important capability of an information system is to extract data from the data store in the form of a data feed. The data feed, a structured system to provide updated data regularly, should have associated properties such as quality and currency of the data so that the organization can determine its usefulness to the reports they produce from that data.

During the extraction and reporting process, many data feeds may be used and these can come from a data store within the organization or may come from a virtual data store outside the organization. The combination of these data feeds can give a new context to the data. This new context is in itself new data and this should be fed back into the data creation and collection process, where the normal collection process occurs.

Applications can also produce reports as well as update the existing data and again, this new data follows the creation process.

Reports may also be used to filter data to increase its usefulness, or to enable distribution and disposal. For example, data from sensors can be aggregated to extract trends, removing personally identifiable information may be achieved through techniques such as anonymization and pseudonymization. The original data can then be similarly extracted and disposed of.

4.4.6 Decide

The decide activity occurs when a decision is made based on the report evaluation. The decisions may be made by people within the organization or by automated means. Suitable agreement is required before automated decision-making takes place; it is important that the decisions and outcomes are monitored.

The main reason for asset data is to support decisions, and the value of data is how they improve the decisions that are made. Reports (including on screen reporting) are examined to provide information upon which decisions are made.

Through a process of delegation, the governing function can ensure that the decisions made are appropriate for the level of responsibility of those decisions. This is of particular importance when decisions are made automatically through simple or complex data flow processes. In any case, the governing function remains accountable for all decisions and should ensure that they have the appropriate controls and, where necessary, apply human intervention to deal with any biases, discrimination or profiling in the decision-making process.

Because the asset management decision-making process values the data, that information may be fed back into the data collection and creation process. By creating this data maintenance and feedback loop, it is

possible to fine tune the reports that are created, the data feeds that are used and ultimately, the data that is fed into the system. Together, this loop increases the value of the decisions made and that in turn can improve the organization's performance.

4.4.7 Distribute

The distribute activity involves extraction or copying of data via the reporting activity for circulation to external parties.

Data may be extracted from the store and distributed outside the organization. This can occur for several reasons, such as:

a) external reporting is required (e.g. to a government authority);

b) it is part of a business-to-business (B2B) data exchange, customer use or similar activity;

c) the data are being sold (e.g. to an advertising agency or survey company);

d) the data are part of the publishing business of the organization (e.g. business data, i.e. the data are the product);

e) the distribution was not authorized, in which case this would be classified as a data breach.

4.4.8 Dispose/archiving

The dispose activity usually involves identifying data for disposal via the report activity and then permanently removing that data and any duplicates from the data store. In the case of a data feed, this would be the permanent disconnection to that feed.

The increasing sophistication of data analysis, mining and learning tools increases the value of existing data because more information can be extracted from more data. This fact, combined with the reduced cost of keeping data, reduces the necessity to dispose of data.

There are a number of reasons why some data should be extracted from the store (via the reporting activity) and securely disposed of, for example:

a) to reduce the risk of data leakage; if the data no longer exists, it cannot be inappropriately distributed or used;

b) to remove irrelevant or incorrect data; although older data may be used for trend analysis, its relevance and correctness should also be considered;

c) to comply with contractual arrangements with customers or suppliers;

d) to comply with legal or regulatory requirements.

Moving data to off-line storage, perhaps using removable recording media, allows the data to potentially be retrieved and reused in the future. For archiving to be effective, it is a deliberate activity with appropriate labelling and metadata added to support identification and retrieval of archived data.

5 Delivering value from asset data

5.1 Asset data's role in decision-making

In the management of physical assets, asset data relates to attributes such as cost, risk, performance and service levels. These attributes are integral to the effective and efficient management of the life cycle of physical assets. The data collected on the physical assets are only useful to the organization in as much as enabling the effective and efficient management of the assets to produce a product or deliver a service. Asset data (data on the assets themselves, as well as their cost, risk, performance, condition and service levels) are not usually bought or sold in open markets or in direct transactions.

Asset data can inform decisions in various aspects related to the management of an asset, with improved quality data enabling better decisions to be made during an asset's life cycle. Asset management decision-making includes whole life planning, reliability analysis, risk analysis, work management optimization, demand analysis and sustainability assessment.

The decision-making process drives:

a) the need for and importance of data to support a decision-making process;

b) the importance of good quality data to support the decision;

c) the timeliness and time sensitivity of data to ensure it remains relevant to the decision;

d) the accessibility of asset data to the asset management team.

5.2 Usefulness of asset data

When determining the usefulness of its asset data, the organization should consider:

a) the usefulness of the asset data to its business;

b) the changes over time to the nature and usefulness of asset data;

c) organizational culture and individual behaviours that can change the usefulness of asset data;

d) the prioritization of activities to increase the usefulness of asset data.

Asset data are useful if they support organizational objectives. The usefulness of asset data can be improved by data management and governance processes. Degradation of usefulness can be a direct result of actions taken or through failing to act in response to changing circumstances.

Insufficient management controls through improper governance and lack of business processes are factors that can contribute to degradation of the usefulness of asset data.

Human and behavioural factors can contribute to degradation of the usefulness of asset data including the unauthorized use of asset data, theft or espionage.

The asset data of an organization and the processes for managing and utilizing them are complex. It is unlikely that an organization has all the asset data it requires to the right quality and to have certainty about these factors, therefore allowance should be made for the likely levels of uncertainty relating to asset data.

Changing organizational contexts also impacts the above factors.

5.3 Align with prevailing data standards

Embracing the principles of relevant industry data standards can enhance the utility of asset data. This improvement comes through implementing best practice approaches that align with and support the objectives of asset management.

5.4 Acquisition, storage and disposal of asset data

A clear definition of asset data's useful life, along with clear guidelines for retention timelines and for the disposal of asset data, can contribute to the usefulness of asset data.

5.5 Costs and benefits of the usefulness of asset data

Trade-off in the usefulness of asset data can be affected by the cost versus the respective benefits of the management of the asset portfolio. In relation to the variability of costs and benefits on decisions around retention and disposal in relation to time, the organization should consider and recognize that:

a) the benefits provided can change over time, and some benefits mainly arise at key life cycle stages, such as asset decommissioning, while they can change drastically on unexpected incidents or opportunities, such as disasters or price escalation;

b) the costs of data acquisition and management can change over time as technologies, legislation and situations change, which impacts the life cycle costs of asset data over time;

c) the life cycle costs of asset data, particularly for future asset life cycle phases, should be considered when deciding the approaches required for the organization's asset data.

6 Identifying data assets

6.1 General

An asset is often represented by various data sets. The effective management of these data sets is crucial for the ongoing management of the assets they represent. Managing these data sets separately can lead to changes that undermine their support for the organization's asset management objectives.

Treating such collections of data sets as a data asset can help an organization achieve its asset management objectives requiring additional controls to align with and support these asset management objectives. These data assets may be considered as assets in their own right, and managed accordingly in the asset management system of the organization.

NOTE Annex B provides examples of data assets.

6.2 Key considerations for recognizing data assets

Each organization is different, so decisions about the identification of data assets are different for each organization.

Factors that suggest collections of data sets are treated as a data asset include:

a) high value/risk assets requiring effective ongoing management;

b) data purchased or acquired from external sources;

c) the use of multiple software/technology platforms storing the asset data that may be changed at different timescales;

d) the need for accurate cross-referencing of information across different asset data sets;

e) asset lives that are considerably longer than the lives of the technology (software and hardware) used to store the asset data;

f) the likelihood of regulatory and legislative changes requiring coordinated changes across asset data sets;

g) many overlapping processes using different asset data sets, increasing the risk of data inconsistencies;

h) obsolescence of the formats used to store asset data;

i) the impact of structural organizational changes (reorganization, mergers and demergers) that increase the risk that asset data no longer support asset management objectives.

Each organization will consider these factors differently to identify their data assets; however, not all organizations identify data assets.

7 Managing data assets

7.1 General

7.1.1 Benefits provided by management of data assets

Careful and effective management of data assets supports and enables effective asset management. Organizations should apply ISO 55001 to their data assets in support of effective and efficient management of their asset portfolio. This can include the development of a suitable asset management plan (AMP) for data assets within the strategic asset management plan (SAMP) for the organization.

Data assets can assist organizations to achieve their business objectives. Data asset management objectives and strategies should be aligned with organizational strategies and objectives.

Alignment between data assets and organizational objectives and strategies can lead to the following benefits:

a) identify opportunities, threats and competitive environment;

b) identify stakeholders and their expectations properly;

c) adequately plan and forecast future demands and expectations;

d) select effective strategies;

e) set suitable objectives;

f) make accurate decisions;

g) develop realistic and executable plans;

h) gain visibility into behaviours, cultures and patterns;

i) identify necessary resources and manage them effectively;

j) execute plans efficiently;

k) identify nonconformities and to address them appropriately;

l) manage risks appropriately;

m) gain a better understanding of the levels of service in the services delivered and/or products produced.

7.1.2 Support for organizational objectives

Activities to align data assets to organizational objectives include:

a) identify the data required to support delivery of organizational objectives, services, products and strategies;

b) determine the availability and usability of data assets to meet these requirements and assess whether the data are internal or external to the organization;

c) apply the requirements of asset management standards to data assets;

d) periodically review the alignment of the data assets with the organizational objectives.

7.2 Identify data related to each organizational objective and strategy

The achievement of objectives relies on selecting and then executing strategies and plans which in turn relies on the availability of resources and appropriate data. The availability of current and future resources can depend on effective decision-making, which also relies on having access to appropriate data. Identification

of relevant data assets to each organizational objective and strategy determines the data to be identified, collected, stored, used in decision-making, reported and distributed to assist the organization to achieve its objectives.

Effective governance of the organization ensures that data-informed decision-making achieves its objectives aligned to the risk appetite of the organization.

Understanding the planning and decision-making processes used to develop strategies and objectives enables the data requirements to be identified. Assessing the cost of acquiring, storing and managing data, against the risks incurred by not having that data, allows determination of appropriate data requirements.

NOTE The ISO 19650 series explains the use of organizational information requirements (OIR), asset information requirements (AIR), project information requirements (PIR) and exchange information requirements (EIR) to support better information management.

7.3 Assess data availability

Although organizations typically have large volumes of data, the data needed to support strategies and objectives are not always readily available. Data asset availability can be assessed as:

a) readily available, either internally or externally to the organization;

b) available after internal development (e.g. by processing or combining existing data);

c) available for procurement or after data gathering activities;

d) not available.

Data are not always accessible (for security, organizational or other reasons) to all stakeholders in the organization. Data that exists but is not accessible to the asset management function is considered as "not available".

The achievement of objectives that have not been pursued before, or the analysis of new operating contexts, can need input data from additional sources: internal or external. These additional sources should be identified, risk assessed, quality assessed, cost assessed and prioritized accordingly. The data governance function sets the criteria and constraints for the selection of external data sources. Data management activities design proposals and plans, and then execute appropriately.

Different parts of the organization are usually involved in acquiring, processing and storing data assets. The implementation of an effective data management approach reduces the risk of duplication, inconsistency, poor data or inefficient processing.

7.4 Applying asset management to data assets

Data assets support the achievement of the organizational objectives when they are managed effectively. An organization's context and stakeholders' requirements should be reviewed and determined (see ISO 55001:2024, Clause 4) and its asset management policy, strategies, objectives and plans related to data assets should be developed. Understanding future data asset requirements enables data assets strategies and objectives to be developed and agreed.

Strategies, objectives and plans for different life cycle stages of data assets (covering the define, collect, store, report, decide, distribute and dispose activities) support the achievement of organizational objectives. Strategies for supporting infrastructure (such as hardware, networks, databases and external data resources) also support the sustained usefulness of data assets.

As the organization sets new objectives, and changes or discontinues previous objectives, or its operating context changes, reviews of its data assets can maintain the organization in alignment with its objectives. Changes in objectives can lead to the organization identifying new data assets, changing existing data assets or deleting data assets.

7.5 Interoperability of the data asset

Interoperability should consider processes, functions, software and data to enable complete interoperability. The data aspects of interoperability are an important enabler to achieve complete interoperability.

Data assets support many of an organization's activities and objectives, as well as enabling work across different organizations. The interoperability of a data asset is a key factor in how efficiently and effectively intra-organizational and interorganizational objectives are achieved.

Interoperability of data assets involves an understanding and management of data formats and quality, enabling organizational objectives to be achieved using data assets from multiple sources in combination. Beyond that, interoperability is also concerned with the data semantics. Semantic data interoperability ensures that data are interpreted in the same way by different entities. Semantic data interoperability can be supported by common vocabularies or ontologies. The use of appropriate identifiers ensures that asset data from different sources is correctly associated with the same asset.

Comparable data specifications and structures support the use of multiple data sets in an efficient and effective manner.

Data asset management activities can support the understanding of existing data structures and encourage common approaches across data assets and integration of asset data activities.

7.6 Digital preservation

Technology changes on an ongoing basis, which results in older hardware and software gradually becoming obsolete, potentially leading to a complete inability to access information stored either due to physical media obsolescence or format obsolescence. The usefulness of the data asset is lost or reduced if it is no longer possible to access these data.

Data asset management activities support the development of approaches to ensure that the usefulness of the data asset is available for as long as is required. There are some strategies that can be used in regard to digital preservation, including:

a) assess the consequences of digital data loss;

b) assess the likelihood of data loss based on the storage device technology, data storage format, damage to the hardware, etc.;

c) calculate the risk of digital data loss and prioritize data preservation accordingly;

d) determine available preservation strategies, such as placing the data storage in a secured place, controlling data using structured metadata, regular maintenance of digital data storage, selecting appropriate access tools in case of a technology change, etc.;

e) identify the costs associated with available preservation strategies;

f) select the most appropriate digital preservation strategy based on risk and costs.

7.7 Culture

The organization should promote culture and behaviours relating to the management and usage of asset data and data assets.

Examples of good asset information culture include:

a) data inherent in the management system;

b) communications (e.g. video) explaining value of data to organizational objectives;

c) weekly meetings to visualize data entered and outcomes of data activities;

d) visible and accessible reporting of data and related key performance indicators (KPIs);

e) recognition and incentives for good data activities;

f) mobile working to encourage data entry at the asset/on site;

g) regular meetings between different data users;

h) asset data governance group.

8 Governance

Good governance of asset data and data assets helps meet organizational objectives and deliver responses to changing situations. Governance ensures that there is suitable oversight of the data asset and asset data related activities. Governance of asset data and data assets can be considered from an asset management and/or a data governance perspective.

Organizations governing data and data assets effectively develop and operate approaches that are relevant to their context and management objectives. Approaches to governance often follow the evaluate, direct, monitor (EDM) model, as follows:

a) Evaluate: The governance function evaluates proposals and plans for the implementation and evaluation of data asset management activities to fulfil the asset management objectives of the organization.

b) Direct: The governance function formulates data strategies and policies for the governance of data and assigns responsibilities and accountabilities to build the governance structure.

c) Monitor: The governance body monitors the performance and conformance of asset data and data asset management activities against the set directions.

NOTE ISO/IEC 38505-1 and ISO/IEC TR 38505-2 define approaches to data governance.

Annex A
(informative)

Data activities

A.1 General

NOTE This annex deals mostly with data in general and applies equally to asset data and data assets.

The ability to create, collect, store, maintain, transfer, process and present data to support business processes in a timely and cost-effective manner requires both an understanding of the characteristics of the data that determine its quality, and an ability to measure, manage and report on data quality (see ISO 8000-1).

Most organizations already support their business processes on existing data and information even knowing that there are some uncertainties regarding their quality. One of the first actions an organization should take is to assess its current data and to plan how to improve them.

A.2 Assessing data

There can be many reasons why data degrades, for example:

a) not being kept up to date;

b) not being sufficiently accurate or complete (when updated);

c) data on the same asset in different systems being referenced differently or becoming inconsistent over time;

d) minor or gross errors that are or are not obvious, including the right data entered into the wrong place;

e) inconsistent terminology or descriptions leading to loss or incomplete reports when searching or aggregating data;

f) degradation of storage media;

g) failures of software or interfaces to deal correctly with all types and orderings of data-change life cycles;

h) poorly executed data migrations when new software applications are implemented;

i) business or technology changes that render the information or data difficult to access or create disconnects between new and legacy software and data formats.

A.3 Improving data

There are a range of possible approaches to improving data quality within an organization. These can include step change initiatives to achieve data quality objectives over a defined period and changes to business processes or corporate systems to achieve the organizational objectives over a longer term. Development of an overall strategy is likely to integrate initiatives across this spectrum to improve the quality of data being collected or to provide additional system functionality. Such approaches should seek to demonstrate their success by embedding data quality improvement into sustainable business-as-usual processes.

Improvements to data quality should have clear objectives so that the end point is understood by all participants. Data quality within an organization can change both as a result of activities within a data improvement plan and through day-to-day business activities.

A.4 Storing data

The nature of the asset (whether it is static or mobile, surface or buried, of long or short life, stand-alone or connected with a system) determines the nature of its information life cycle and the system platform(s) best suited to storing aspects of asset information. While there are many variables across asset information, some fundamental features are common:

a) some information attributes are static with low levels of change (e.g. location, date created) or dynamic;

b) information may represent different levels or types of asset (e.g. sites, systems, components) and should align to such agreed levels across the organization;

c) a process model can represent flows of data using updates (on status, condition) from live systems on a regular basis;

d) specification of attributes within the data model should be clear, so that it is applied appropriately with documented assumptions, and to enable the design of data platforms to account for the life cycle of the various attributes held;

e) information about the data (the currency of data held, its accuracy level and reliability), which is often termed "metadata", determines how confidently the information can be applied;

f) modern data stores enable data sets to be interrelated across business units and can display assets spatially in context with other information to provide powerful platforms for decision-support, but are more complex to maintain even for larger enterprises;

g) a range of specialists may be involved in supporting asset information, each with their own skills and perceptions that an asset manager has to command to achieve the benefit from holding and applying asset information.

A.5 Utilizing data

The utilize data phase of the data life cycle should receive a lot of attention as this is where users come into contact with data, but often this attention is misplaced. Poor data requirement definition can result in data being collected and stored because it is perceived to be useful, without full consideration being given to how they are used.

A.6 Acquiring new data

Asset information most often is acquired on asset commissioning, but also can be as a result of surveys or be derived by transfer from other business units, as a result of changes in the organization.

All acquisition processes require a clear understanding of data specifications, the process for acquiring data and where the data are stored.

A.7 Archiving data

Data archiving forms an important part of the asset information life cycle and is often overlooked. There are many different types of data sets that hold asset information and each has their own unique requirements. Questions that should be considered when deciding upon archival requirements include:

a) what should be archived and why;

b) for how long should documented information be retained;

c) what are the obligations, legal or otherwise, for retaining documented information (these can include regulatory, statutory and legal obligations as well as internal business requirements);

d) where there are obligations related to data retention, who is responsible for ensuring these obligations are met;