



BSI Standards Publication

Intelligent device management

Part 1: Concepts and terminology

National foreword

This British Standard is the UK implementation of IEC 63082-1:2025. It supersedes PD IEC TR 63082-1:2020, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/65/5, Devices and integration in enterprise systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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**Intelligent device management -
Part 1: Concepts and terminology**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Intelligent device management - Part 1: Concepts and terminology

FOREWORD

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IEC 63082-1 has been prepared by subcommittee 65E: Intelligent Device Management, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This first edition cancels and replaces the first edition of IEC TR 63082-1 published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC TR 63082-1:2020:

- a) alignment with clause structure of IEC 63082-2.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/1175/FDIS	65E/1182/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 63082 series, published under the general title *Intelligent device management*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The purpose of the IEC 63082 series is to define an environment that enables the effective use of intelligent devices. The IEC 63082 series defines common concepts, terminology, and management activities.

Intelligent device management (IDM) represents activities for managing intelligent devices through the facility life cycle and does not imply a particular asset management tool or set of those tools. Hardware and software tools are necessary to support work processes and procedures, but specification of the tools is not a part of the IEC 63082 series. IDM is one of many enterprise programs. IDM activities optimize the value from intelligent devices and supports integration of data from the production level with business systems. IDM is consistent with smart manufacturing initiatives.

Several stakeholders are responsible for delivering successful intelligent device management, including engineering, procurement, and construction (EPC) contractors, owner operators, system integrators, suppliers, and consultants.

The IEC 63082 series is not intended to replace or contradict other standards, for example IEC 61511 (all parts) for safety instrumented systems and IEC 62443 (all parts) for cybersecurity.

While the work processes and implementation practices specified in the IEC 63082 series might be used for non-automation equipment with some diagnostic capability, the IEC 63082 series does not cover these equipment types.

The IEC 63082 series consists of the following parts:

- IEC 63082-1: Concepts and terminology;
- IEC 63082-2: Requirements and recommendations.

This document defines intelligent device management concepts and terminology necessary for in-depth understanding and effective communication. It gives the basic concepts of how intelligent devices can be managed and an overview of how this device management works throughout the facility life cycle. This document provides basic knowledge to understand the concepts of intelligent device management necessary to implement an IDM program.

IEC 63082-2:2024 provides provisions (requirements and recommendations) in the body of the document. Additional information on why a requirement is given are provided in its Annex A. The information provided in this document is intended to be useful as background material for better understanding of the provisions in IEC 63082-2. As both IEC 63082-1 and IEC 63082-2 are based on the same lifecycle model effort has been made to align the clauses/headings between the two documents, thus making it easier for the reader to correlate content.

1 Scope

This part of IEC 63082 defines the concepts and terminology necessary to understand and communicate effectively about intelligent device management (IDM). This document explains the relationship between IDM and other existing asset management standards.

Additionally, this document describes principles and defines organizational and functional structures associated with IDM. This document also introduces the concept of IDM program for coordination of multiple stakeholders.

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.

IEC 63082-2:2024, *Intelligent device management - Part 2: Requirements and recommendations*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the following terms, definitions, and abbreviated terms apply.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 Terms and definitions

3.1.1 activity

set of actions that consume time and resources (3.1.60) and whose performance is necessary to achieve, or contribute to, the realization of one or more objectives

Note 1 to entry: It includes work processes (3.1.76), procedures (3.1.55), and tasks (3.1.69).

[SOURCE: ISO/IEC TR 24766:2009, 3.1, modified – "outcomes" replaced with "objectives"]

3.1.2 alarm

notification (3.1.47) to the operator (3.1.49) of an equipment (3.1.25) malfunction, process deviation, or abnormal condition requiring a unique, timely, and documented (predetermined) response from the operator

[SOURCE: IEC 62682:2022, 3.1.7, modified – "audible and/or visible means of indicating" was replaced with "notification", "unique," was added, "and documented (predetermined)" was added, and "from the operator" was added]

3.1.3 alarm management

collection of processes and practices for determining, documenting, designing, operating, monitoring, and maintaining alarm (3.1.2) systems

[SOURCE: IEC 62682:2022, 3.1.17]

3.1.4

alert

notification (3.1.47) to responsible persons of an abnormal condition that can require actions with a time tolerance much longer than for alarms (3.1.2)

Note 1 to entry: "Responsible persons" can include operators (3.1.49), maintenance (3.1.42) personnel, and engineering personnel.

3.1.5

apparatus

device (3.1.17) or assembly of devices which can be used as an independent unit for specific functions

EXAMPLE Apparatus includes intelligent measuring and control devices, inspection (3.1.34) and testing (3.1.70) devices, and host systems (3.1.31).

[SOURCE: IEC 60050-151:2001, 151-11-22, modified – Note was deleted, and EXAMPLE was added]

3.1.6

asset

physical entity or digital entity that has value to an individual, an organization or a government

[SOURCE: ISO/IEC 20924:2018, 3.1.4]

3.1.7

asset management

coordinated activities of an organization (3.1.50) to ensure the intended capability of assets (3.1.6) is available

Note 1 to entry: The capability of an asset is dynamic and asset management will respond to satisfy changing objectives.

[SOURCE: ISO 55000:2014, 3.3.1, modified – "to realize value from assets" was replaced with "to ensure the intended capability of assets is available", Notes to entry were deleted, a new Note 1 to entry was added]

3.1.8

calibration

procedure (3.1.55) of checking and when necessary adjusting (by comparison with a reference standard) the accuracy of a measuring instrument

[SOURCE: ISO 15378:2017, 3.3.2, modified – "process" was replaced with "procedure" and "or" was replaced with "and when necessary"]

3.1.9

certification

procedure (3.1.55) by which a third party gives documented assurance that a product, process, or service conforms to specified requirements (3.1.59)

[SOURCE: IEC 61400-22:2010, 3.4, modified – "written" was replaced with "documented" and "also known as conformity assessment" was deleted]

3.1.10

commissioning

procedure (3.1.55) prior, or related, to the handing over of a product ready for putting into service, including final acceptance testing (3.1.70), the handing over of all documentation relevant to the use of the product and, if necessary, instructing personnel

[SOURCE: IEC 82079-1:2012, 3.3, modified – "procedures" was replaced with "procedure"]

3.1.11

configuration database

structured collection of parameter settings for intelligent devices (3.1.36)

3.1.12

corrective action

action to eliminate the cause of a non-fulfilment of a requirement (3.1.59) and to prevent recurrence

[SOURCE: ISO 55000:2014, 3.4.1, modified – "nonconformity" was replaced with "non-fulfilment of a requirement", Note 1 to entry was deleted]

3.1.13

covert fault

fault (3.1.29) in relation to hardware and software, undetected by the diagnostics (3.1.22), proof tests, operator (3.1.49) intervention (for example physical inspection (3.1.34) and manual tests), or through normal operation (3.1.46)

Note 1 to entry: These are sometimes called latent faults or unknown faults.

[SOURCE: IEC 61508-4:2010, 3.8.9 covert, modified – "fault" and "and software" were added, "diagnostic test" was replaced with "diagnostics", EXAMPLE was deleted, Note 1 to entry was added]

3.1.14

critical infrastructure

sectors whose assets (3.1.6), technologies, services, systems, and networks, whether physical or virtual, are considered vital to a nation in that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety

3.1.15

criticality

degree of risk (3.1.61) represented by specified set of levels

3.1.16

decommissioning

act of taking an engineered system or component out of service, render it inoperative, dismantle and decontaminate it

[SOURCE: ISO 27914:2017, 3.13, modified – "decommission" was replaced with "decommissioning", change "take" was replaced with "act of taking"]

3.1.17

device

independent physical entity capable of performing one or more specified functions in a particular context and delimited by its interfaces

[SOURCE: IEC 61499-1:2012, 3.29, modified – Note 1 to entry was deleted]

3.1.18

device configuration

procedure (3.1.55) that loads parameters into an intelligent device (3.1.36) to define its function

3.1.19

device life cycle

period of time over which a device (3.1.17) with a specific model code is developed, brought to market and eventually removed from the market

3.1.20**device monitoring**

monitor (3.1.45) that tracks behaviour of a device (3.1.17), providing notifications (3.1.47) of events for the device and for all calls associated with the device

[SOURCE: ISO/IEC TR 18053:2000, 3.141, modified – term "Device-Type Monitor" was replaced with "device monitoring", "A" was removed]

3.1.21**device template**

set of predefined parameters which characterize a specific device (3.1.17) release for a particular type of application

Note 1 to entry: Device templates are normally prepared by the device supplier (3.1.68).

3.1.22**diagnostics**

automated function which detects faults (3.1.29), malfunctions, deviations, and/or variations of hardware or software

Note 1 to entry: Diagnostics can be initiated manually for off-line diagnostics (3.1.48).

Note 2 to entry: "Diagnostic" is used for an adjective and as a generic word.

3.1.23**enterprise**

group of organizations (3.1.50) sharing a set of goals and objectives to offer products or services or both

[SOURCE: ISO 14258:1998, 2.1.1, modified – "a" was deleted]

3.1.24**enterprise infrastructure**

basic physical and organizational structures needed for operations of an enterprise (3.1.23)

3.1.25**equipment**

single apparatus (3.1.5) or set of devices (3.1.17) or apparatuses, or the set of main devices of an installation (3.1.35), or all devices necessary to perform a specific task (3.1.69)

EXAMPLE Intelligent measuring and control devices, inspection (3.1.34) and testing (3.1.70) devices, and host systems (3.1.31).

[SOURCE: IEC 60050-151:2001, 151-11-25, modified – Note was deleted, EXAMPLE was added]

3.1.26**facility**

physical entity that is built, constructed, installed or established to perform some particular function or to serve or facilitate some particular end

EXAMPLE A plant, factory, mill, and site.

[SOURCE: IEC TR 62066:2002, 3.6, modified – parentheses were removed, EXAMPLE was added]

3.1.27**facility implementation project**

set of activities to put into practice before the facility (3.1.26) starts or continues its intended service

3.1.28**failure**

loss of the ability to perform as required

Note 1 to entry: A failure of an item is an event that results in a fault (3.1.29) of that item.

Note 2 to entry: Qualifiers, such as catastrophic, critical, major, minor, marginal and insignificant, can be used to categorize failures according to the severity of consequences, the choice and definitions of severity criteria depending upon the field of application.

Note 3 to entry: Failure could lead to loss of a single function of an item (e.g. secondary function such as diagnostics (3.1.22)) not impacting the primary function of the item.

Note 4 to entry: For this definition "failure" refers to failure of "a device" (3.1.17).

[SOURCE: IEC 60050-192:2015, 192-03-01, modified – <of an item> was deleted, Note 3 to entry was modified, Note 4 to entry was added]

3.1.29**fault**

inability to perform as required, due to an internal state

Note 1 to entry: A fault of an item results from a failure (3.1.28), either of the item itself, or from a deficiency in an earlier stage of the life cycle (3.1.40), such as specification, design, manufacture or maintenance (3.1.42).

Note 2 to entry: Qualifiers, such as specification, design, manufacture, maintenance, or misuse, can be used to indicate the cause of the fault.

Note 3 to entry: For this definition "fault" refers to fault of "a device" (3.1.17).

[SOURCE: IEC 60050-192:2015, 192-04-01, modified – "of an item" was deleted, Note 2 to entry was modified, Note 3 and Note 4 to entry was deleted, and new Note 3 to entry was added]

3.1.30**foundational requirement**

requirement (3.1.59) that serves as a basis for derivation of detailed requirements

EXAMPLE Management of risk (3.1.61), management of functionality and performance, management of change (3.1.43).

Note 1 to entry: Foundational requirements might not be directly actionable, but their derived requirements can be a basis for action.

3.1.31**host system**

functions or tools (3.1.71) that digitally communicate with intelligent devices (3.1.36)

Note 1 to entry: Functions include automated fault (3.1.29) handling, management of notifications (3.1.47), and configuration management of intelligent devices.

Note 2 to entry: Functions and tools can be provided on one or more host systems.

3.1.32**incipient fault**

imperfection in the state or condition of a device (3.1.17) so that a degraded performance or critical failure (3.1.28) might eventually be the expected result if corrective action(s) (3.1.12) is (are) not taken

[SOURCE: ISO 14224:2016, 3.40, modified – term "incipient failure" was replaced with "incipient fault", "an item" was replaced with "a device", "or critical failure might (or might not)" was replaced with "performance or critical failure might", and "actions are" was replaced with "action(s) is (are)"]

3.1.33**industrial automation control system****IACS**

collection of personnel, hardware, software and policies involved in the operation of the industrial process and that can affect or influence its safe, secure and reliable operation

[SOURCE: ISA-62443-3-3:2013 [3.1.29]]

3.1.34**inspection**

action comprising careful scrutiny of a device (3.1.17) and its immediate environment in order to arrive at a reliable conclusion as to the condition of a device

[SOURCE: IEC 60050-426:2008, 426-14-02, modified – "an item" was replaced with "a device" and "carried out either without dismantling, or with the addition of partial dismantling as required, supplemented by means such as measurement," was replaced with "and its immediate environment"]

3.1.35**installation**

one apparatus (3.1.5) or a set of devices (3.1.17) and/or apparatuses associated in a given location to fulfil specified purposes, including all means for their satisfactory operation

[SOURCE: IEC 60050-151:2001, 151-11-26]

3.1.36**intelligent device**

configurable device (3.1.17) having digital communication with supplemental functions such as diagnostics (3.1.22) in addition to its basic purpose

EXAMPLE 1 Process connected devices, which are in level 1 of the IEC 62264 functional hierarchy, such as smart instruments, valves and actuators, analysers, custody transfer meters, electrical breakers, and transformers.

EXAMPLE 2 Control devices, which are in level 2 of the IEC 62264 functional hierarchy, such as PLCs, data acquisition subsystems, and dedicated HMI devices.

EXAMPLE 3 Other devices such as RTUs, managed industrial network routers, converters and gateways.

3.1.37**intelligent device management****IDM**

formal coordinated business objectives, organizations (3.1.50), work processes (3.1.76), and resources (3.1.60) to realize value from intelligent devices (3.1.36)

Note 1 to entry: IDM program (3.1.38) is used to achieve setup (provisioning (3.1.57), engineering, configuration and calibration (3.1.8)), optimization, diagnostics (3.1.22), maintenance (3.1.42) and disposal of intelligent devices over the facility life cycle (3.1.40) based on asset management (3.1.7).

Note 2 to entry: IDM can be applied to multiple facilities of an enterprise (3.1.23) or a facility (3.1.26) of an enterprise.

[SOURCE: definition of "asset management" by ISO 55000:2014, 3.3.1, modified – "assets" was replaced with "intelligent devices" and Notes to entry were added]

3.1.38**intelligent device management program****IDM program**

set of coordinated policies, strategies, activities, resources (3.1.60), and organization (3.1.50) to achieve IDM (3.1.37) objectives

Note 1 to entry: IDM program is a type of enterprise (3.1.23) program.

3.1.39

intelligent device management system

IDMS

type of host system (3.1.31) that facilitates a seamless exchange and retrieval of information about intelligent devices (3.1.36) between multiple functional departments and across an organization's (3.1.50) facilities, while also allowing live access to device (3.1.17) information and configuration

Note 1 to entry: An IDMS is not based on a specific technology nor a predetermined/rigid architecture.

3.1.40

life cycle

finite set of generic phases and steps which a system will go through over its entire life history

EXAMPLE A typical system life cycle consists of: concept and definition; design and development; construction, installation (3.1.35) and commissioning (3.1.10); operation and maintenance (3.1.42); mid-life upgrading, or life extension; and decommissioning (3.1.16) and disposal.

[SOURCE: IEC 60050-192:2015, 192-01-09, modified – "may" was replaced with "will" and EXAMPLE added]

3.1.41

loop

all the hardware and software necessary to work together for the measurement, communication, and/or control of a process variable

Note 1 to entry: The loop consists of all associated components and functions including sensor, logic, control, actuator, and HMI.

Note 2 to entry: Loop checking is described in IEC 62382.

3.1.42

maintenance

activity (3.1.1) including supervisory actions, intended to retain an item in, or restore it to, a state in which it can perform a required function

[SOURCE: IEC 60050-192:2015, 192-06-01, modified – "combination of all technical and management actions" was replaced with "activity including supervisory actions," "as required" with "a required function", and Note 1 was removed]

3.1.43

management of change

MOC

process of controlling and documenting any change in a system to maintain the proper operation of the equipment (3.1.25) under control

[SOURCE: IEC 62443-2-1:2010, 3.1.8, modified – "change management" was replaced with "management of change"]

3.1.44

management program

activity (3.1.1) that oversees a group of related projects and/or work processes (3.1.76) in a way that provides benefits and control not available by running each activity individually and independently

3.1.45

monitor, verb

acquire a quantity value continuously or sequentially in order to check whether it is within normal operating limits and, where appropriate, to signal if it passes its tolerance boundaries

[SOURCE: IEC 60050:2015 351-43-03]

3.1.46

normal operation

operation of apparatus (3.1.5) conforming electrically and mechanically within design specification and used within the limits specified by the apparatus manufacturer

[SOURCE: IEC 60050-426:2020, 426-04-10, modified – <explosive atmospheres> was deleted, "equipment" was replaced with "apparatus", "with its" was replaced with "within", and Notes were removed]

3.1.47

notification

means of communicating a value, state, condition, or symptom to an intended recipient

3.1.48

off-line diagnostics

diagnostics (3.1.22) which is performed while device (3.1.17) is out of service

3.1.49

operator

person who monitors (3.1.45) and makes changes to the production process of the facility (3.1.26)

[SOURCE: IEC 62682:2022, 3.1.64, modified – "process" was replaced with "process of the facility"]

3.1.50

organization

body that is based on the membership of other bodies or individuals and has an established constitution and its own administration

[SOURCE: ISO/IEC Guide 2:2004, 4.2]

3.1.51

overt fault

fault (3.1.29) in relation to hardware and software, detected by the diagnostics (3.1.22), proof tests, operator (3.1.49) intervention (for example physical inspection (3.1.34) and manual tests), or through normal operation (3.1.46)

[SOURCE: IEC 61508-4:2010, 3.8.8 overt, modified – "fault" and "and software" were added, "diagnostic test" was replaced with "diagnostics", EXAMPLE and NOTE were removed]

3.1.52

owner operator

enterprise (3.1.23) or agency responsible for the day-to-day operation of a facility (3.1.26)

Note 1 to entry: Owner operator can contractually delegate some or all these responsibilities.

3.1.53**preventive maintenance**

maintenance (3.1.42) carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure (3.1.28) or the degradation of the functioning of an item

[SOURCE: IEC 60050-192:2015, 192-06-05, modified – "to mitigate degradation and" was replaced with "at predetermined intervals or according to prescribed criteria and intended to", "or the degradation of the functioning of an item" was removed, and Note 1 was removed]

3.1.54**proactive maintenance**

preventive maintenance (3.1.53) which is carried out based on alerts (3.1.4) from the devices (3.1.17)

3.1.55**procedure**

sequence of tasks (3.1.69) with a defined beginning and end that is intended to accomplish a specific objective

3.1.56**prompt**

notification (3.1.47) that requires the responsible person to take an action that is part of normal operation (3.1.46)

3.1.57**provisioning**

process of pre-configuring some static information that includes network identifier, security level, join key, and shared key for the intelligent devices (3.1.36)

[SOURCE: IEC 62948:2017, 3.1.25, modified – "WIA-FA" was removed.]

3.1.58**quality management system****QMS**

organization (3.1.50) framework whose structure provides the policies, processes, procedures (3.1.55), and resources (3.1.60) required to implement the quality management plan

Note 1 to entry: The typical project quality management plan ought to be compatible to the organization's quality management system.

[SOURCE: ISO/IEC 30105-4:2016, 3.41, modified – "the" was deleted and "should" was changed to "ought to" in Note 1]

3.1.59**requirement**

expression, in the content of a document, that conveys objectively verifiable criteria to be fulfilled and from which no deviation is permitted if conformance with the document is to be claimed

Note 1 to entry: Requirements can describe an essential service, capability, feature or activity (3.1.1).

[SOURCE: ISO/IEC Directives Part 2:2021, 3.3.3]

3.1.60

resources

people, procedures (3.1.55), software, information, equipment (3.1.25), consumables, infrastructure, capital and operating funds, and time

[SOURCE: ISO/IEC 38500:2015, 2.21]

3.1.61

risk

combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014, 3.9, modified – "Note 1 to entry" was removed]

3.1.62

risk analysis

systematic use of available information to identify hazards and to estimate the risk (3.1.61)

[SOURCE: ISO/IEC Guide 51:2014, 3.10]

3.1.63

risk assessment

overall process comprising a risk analysis (3.1.62) and a risk evaluation (3.1.64)

[SOURCE: ISO/IEC Guide 51:2014, 3.11]

3.1.64

risk evaluation

procedure (3.1.55) based on the risk analysis (3.1.62) to determine whether tolerable risk (3.1.61) has been exceeded

[SOURCE: ISO/IEC Guide 51:2014, 3.12]

3.1.65

risk management

process of identifying and applying countermeasures commensurate with the value of the assets (3.1.6) protected, based on a risk analysis (3.1.62)

[SOURCE: IEC 62443-1-1:2009, 3.3.89, modified – "assessment" was replaced with "analysis"]

3.1.66

status

state

distinct condition of an object

Note 1 to entry: The object can be a system, a process unit, a machine, etc. Conditions can be operation modes — either normal (e.g. "on", "closed", "standby") or abnormal (e.g. "disturbed"). They can be determined by checking values of variables against limits (e.g. "too high" or "high alarm").

[SOURCE: ISO 11064-5:2008, 3.26, modified – "may" was replaced with "can"]

3.1.67

status notification

notification (3.1.47) that helps provide the responsible person situational awareness, is part of normal operation (3.1.46) and does not require operator (3.1.49) action

3.1.68

supplier

party that produces, provides, or furnishes an item, system, or service

[SOURCE: ISO 28219:2017, 3.11, modified – "system" was added]

3.1.69

task

single piece of work that needs to be done and does not have interacting elements requiring management

[SOURCE: IEC 62304:2006, 3.31, modified – "a" was deleted, "and does not have interacting elements requiring management" was added]

3.1.70

testing

determination of one or more characteristics of an object of conformity assessment, according to a procedure (3.1.55)

Note 1 to entry: "Testing" typically applies to materials, products or processes.

[SOURCE: IEC 60050-902-03-02:2013]

3.1.71

tool

software or hardware element intended for a defined task (3.1.69) which has been specifically designed or adapted, tested and maintained for aiding off-line or live working

Note 1 to entry: "Tools" is also used as a general term to indicate any tool, device (3.1.17) or equipment (3.1.25) for off-line or live working. Live working can be on process or in a workshop.

Note 2 to entry: tools can be an executable software program which interacts with the user (3.1.75) to perform some function (e.g., Link scheduling software (LSS)).

[SOURCE: IEC 60050-651:2014, 651-21-14, modified – "material" was replaced with "software or hardware", "aiding off-line or" was added, and Note 1 to entry was modified to include "off-line" as well as that "Live working can be on process or in workshop". Note 2 entry was added. EXAMPLE was removed]

3.1.72

toolkit

set of documents and tools (3.1.71) that defines and supports work processes (3.1.76), project management, and typical configuration

Note 1 to entry: Tools can be hardware and/or software.

[SOURCE: IEC 60050 651:2014, 651-21-14]

3.1.73

typical configuration data set

device template (3.1.21) for a particular facility (3.1.26) prepared by the personnel performing the host system (3.1.31) configuration

3.1.74

turnaround

scheduled activity (3.1.1) wherein a facility (3.1.26) is taken off-line for maintenance (3.1.42)

EXAMPLE Planned shutdown.

3.1.75**user**

hardware, software or human entity that is the initiator and/or target of content consumption

[SOURCE: ISO/IEC 14496-13:2004, 3.18, modified – "A" was removed]

3.1.76**work process**

set of interrelated or interacting procedures (3.1.55) which transforms inputs into outputs

[SOURCE: ISO 9000, ISO 55000, modified – "activities" was replaced with "procedures"]

3.2 Abbreviated terms

D/A	Digital to Analogue
EPC	Engineering, Procurement, and Construction
FAT	Factory Acceptance Test
HMI	Human Machine Interface
IACS	Industrial Automation Control System
IDM	Intelligent Device Management
IDMS	Intelligent Device Management System
KPI	Key Performance Indicator
LSS	Link Scheduling Software
MOC	Management of Change
MTBF	Mean Time Between Failures
PLC	Programmable Logic Controller
PSSR	Pre-Startup Safety Review
PV	Process Value
QMS	Quality Management System
RTU	Remote Terminal Unit
SAT	Site Acceptance Test
SIS	Safety Instrumented System
SIT	Site Integration Test
UML	Unified Modelling Language

4 Foundational requirements for IDM**4.1 Objective**

Foundational requirements apply to all life cycles to advance and sustain IDM.

The foundational requirements described in Clause 4 apply to all activities, technologies, products, and services related to IDM, including but not limited to intelligent devices, industrial automation control system (IACS) hardware and software, and its management by providing the basis for detailed or derived requirements on which IDM is based.

4.2 General

Clause 4 introduces concepts that include:

- basic management functions necessary for any technology that form a vital part of IDM;
- organization of activities into formally and informally managed parts;
- management of change (MOC); and
- risk management.

These four foundational concepts form the basis for IDM.

4.3 Management functions

IDM, like any other program, cannot exist without active support from and accountability of enterprise management. IDM requires support from management and in turn needs to provide support to management for effective implementation. The types of support include but are not limited to:

- budget and personnel resources;
- coordination with other programs and with all stakeholders;
- adapting to organizational changes and technology changes;
- setting expectations for risk management;
- accountability through tracking and reporting of program performance;
- support for continuous improvement.

The overall set of technical and management functions for IDM comprise an IDM program. The IDM program's main job or goal is to make the technical and management functions work together. This is a complex endeavour with many overlapping activities and roles. A common understanding of the functions and roles is necessary to make IDM a success.

4.4 Formal and informal work processes and procedures

One of the primary responsibilities of IDM is support for management of work processes and procedures. This management includes a decision process for deciding which processes and procedures need to be formally managed and which can be informal. (Annex C applies for an explanation of the relationships between programs, work processes, procedures and tasks.) Programs, work processes, and many procedures are complex enough to justify formal documentation and training. Some tasks can be supported with informal training without extensive documentation or formal processes.

Example criteria for creating a formal work process or procedure include:

- high complexity;
- number of people or organizations involved;
- transitions in ownership or multiple owners during the life cycle;
- high risk levels;
- frequency of use;
- high availability/reliability requirements; and
- need for stability, reproducibility, and accuracy over long time periods.

Example contents of formal work processes and procedures include:

- defined starting conditions or inputs;
- defined critical conditions (alarm/trip)
- defined internal processes including defined roles and responsibilities;
- defined criteria for changing the approved instrumentation list;
- defined toolkits and enterprise infrastructure;
- defined staff resources (numbers, identity, and competency);
- defined external interfaces;
- defined completion and output;
- defined financial support, measures of success, and management accountability; and
- formal documentation and training.

Work processes also typically include swim lane diagrams in addition to the above items.

Formal organization to activities helps to minimize two types of error:

- errors of omission where needed actions are not performed in a timely manner;
- errors of commission where actions are performed incorrectly.

Formal organization of activities can result in a significant reduction in risk. The formal organization is often the most cost-effective option for complex activities.

4.5 Management of change

4.5.1 General

Management of change (MOC) is a necessary function of operating a facility. Change is imposed on users by internal and external factors including the need to modernize or optimize facility operations, and changes in the supply of products used by the facility.

MOC is necessary to ensure safety and operability of facilities. It is also a legal requirement in many jurisdictions (such as USA and EU) and industries. Both civil and criminal liabilities have been enforced for lack of MOC.

4.5.2 Impact assessment

Some changes are trivial, and some are quite complex and can have significant impact. When any change is made, the impact is to be assessed before the change is made so that the MOC process is used to assess the impact of the change before it can be performed. MOC applies to any changes in facility scope and risk management measures to a simple pre-approved modification. Subclause 8.3 applies for more on managing life cycle phases.

4.5.3 Planning

MOC often occurs at times when there is some urgency for completion of a change (e.g. completion of a repair). The urgency can be accompanied by a lack of engineering resources to cover the impact assessment.

The most impactful type of planning is the preplanned and preapproved change. IDM can support this through backward compatibility of device revisions. Backward compatibility occurs when the:

- new revision is guaranteed to perform the functionality of the older revision with the same performance;
- new revision can use the same configuration used by the older revision.

Suppliers can provide this capability for users. It is a valuable service.

When this service is provided by the suppliers, it is worthwhile to have a process in place to test the compatibility between the different revisions and document the impact.

Planning is more extensive when the change causes a change in functionality, engineering records, or in procedures.

Planning is to be complete before changes are implemented.

4.5.4 Training

Training is necessary so that facility personnel can recognize when MOC has been preplanned and preapproved, and what is the proper course of action if the change is not preapproved. Training is also necessary to make personnel aware that changes cannot be made without impact assessment and planning. Training is necessary to inform people of documentation requirements for changes. Training also might be required when the change causes a need for new procedures.

4.5.5 Documentation

MOC documentation includes records of impact assessment, planning, and training.

4.5.6 Retention of data and documents

Documents are retained to capture conditions before the change, the contents of the change, and conditions after the change.

4.6 Risk management

Risk management is a foundational requirement for IDM. IDM provides an optimized methodology for managing risk by managing complexity to provide efficient work processes that lower risk while managing costs.

Risk management includes activities that ensure the technology employed in IDM is appropriate for the functional, performance, and risk requirements of a facility.

Risk management is a complex activity affecting all parts of an enterprise. Informal processes are not adequate for the scope and complexity of risk management.

5 Risk management

5.1 Objective

Clause 5 identifies complementary work processes an enterprise requires to eliminate, minimize, or control any potential risks associated with IDM. Clause 5 also describes the need for a comprehensive risk management plan in IDM.

5.2 General

The IDM risk management process includes the identification of any potential threats that can occur during implementation of IDM.

5.3 IDM program requirements

IDM programs provide the organizational and management support required to make IDM risk management successful. The IDM program provides continuous support for risk management activities within an enterprise.

5.4 Program coordination

IDM risk management cannot be isolated from other enterprise programs. Coordination is required to ensure all programs within an enterprise are synchronized and work together.

5.5 Facility life cycle

There are many activities involved in the facility life cycle. Effective facility life cycle risk management ensures the coordination of simultaneous and sequential activities from initiation to ending.

Thorough risk identification including all types of event triggers and their cascading effects ensures the effectiveness of the facility risk reduction process throughout the facility life cycle.

Any changes will be properly reviewed and managed. A change not properly managed will lead to financial, production, schedule delays, resource constraints and other impacts.

Auditing, continuous oversight and monitoring of the IDM risk management process will maintain the integrity of the IDM program throughout the facility life cycle.

5.6 Supplier risk management

A facility needs a consistent reliable supply of products and services throughout the facility life cycle. It is necessary to manage all supplier changes, authenticity, and associated risks. Managing these risks requires coordination between suppliers, facilities and programs.

5.7 Information management risks

Information management brings order and coordination to accessing the information needed for an effective risk management program. Risk management decisions made with inadequate information can lead to improper decisions resulting in higher risk and potential for chaos.

5.8 Cybersecurity

Management of cybersecurity is an integral part of IDM. Because devices live at the lowest level in the industrial network (level 0 in IEC 62264-1), cybersecurity is necessary to protect the integrity of every network level and not only the device functions. Many cybersecurity measures apply to system functions and others apply to devices. Both system level and device level cybersecurity measures need to work together to protect overall functional integrity.

Cybersecurity measures include technical capabilities and procedures used to implement those technical capabilities. Guidance for technical capabilities and procedures are given in the IEC 62443 series of documents.

Cybersecurity in IDM is important because intelligent devices can have their functionality altered electronically either locally or remotely.

When local support is not available, intelligent devices through their digital connections present an opportunity for agencies external to the facility to provide remote support. Digital networks with appropriate cybersecurity measures in place make it possible to access the information needed to troubleshoot a problem remotely without the cost and time of bringing the expertise to the facility. As a result, of this level of potential connectivity, cybersecurity is an enabling technology as well as a source of potential threats to the integrity of enterprise networks.

The analysis and classification processes in IEC 62443 provide guidance on managing this cybersecurity risk and therefore apply to all intelligent devices.

NOTE Rules appropriate for applicable security levels are found in IEC 62443-3-3.

6 Enterprise level management for IDM

6.1 Objective

Clause 6 introduces the organizational structures and activities necessary for IDM. This document only introduces concepts and terminology.

NOTE The details of the work processes and the roles of personnel performing these activities are not covered in this document.

The objective of enterprise level management is to provide a means for development, maintenance, and improvement of the overall systems that drive the performance of intelligent devices for the enterprise.

Enterprise level IDM includes but is not limited to:

- a) a program or policy including management activities, standards and a basis for enterprise infrastructure including host systems;
- b) resource definition and planning including competencies and budget; and
- c) planning and coordination of a comprehensive set of life cycles including work processes and coordination between facilities.

The objective of IDM is to achieve required functions, expected performance, and availability of intelligent devices with acceptable risk at minimum cost by utilizing features of intelligent devices. Unfortunately, most intelligent devices are only used to perform their primary function of providing the process variable. Digital communication and auxiliary functions can maximize the value of the device but can also complicate replacement in a later stage when similar devices are no longer available.

NOTE A summary of IDM objectives and associated work processes are described in Annex D.

6.2 General

The primary challenge of IDM is its perceived complexity. To meet the challenges and capture the benefits of IDM, stakeholders (suppliers, EPC contractors, owner operators, and service providers) all need to understand their role in proper implementation and use of the tools and support systems for intelligent devices.

IDM consists of several interactive and interdependent activities. To accomplish IDM goals, the management of these activities requires formal structure, and the structure needs to be clearly documented.

The IDM structure described through this set of documents and related standards can be implemented for both existing facilities and new facilities.

The lack of standardized work processes and available skills at a site are a challenge for dealing effectively with the potential complexity of IDM.

6.3 Organization and resources

6.3.1 Relationship to asset management

IDM is based on asset management concepts that are outlined in ISO 55000 and specified by ISO 55001. Therefore, IDM aligns with the basic requirements specified by ISO 55001.

As ISO 55000 mentions, the nature and purpose of an organization and its operating environment all have a strong influence on the type of assets that the organization needs to achieve its objectives. An organization's and its stakeholders' intents are translated into design criteria for asset management.

Figure 1 shows the relationship between IDM and intelligent devices in the context of asset management.

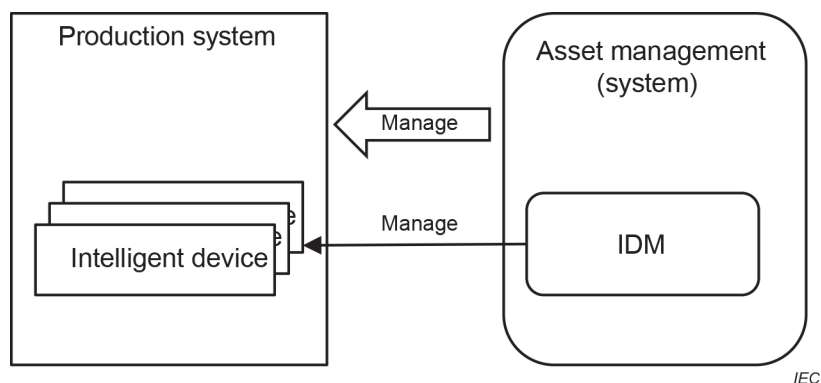


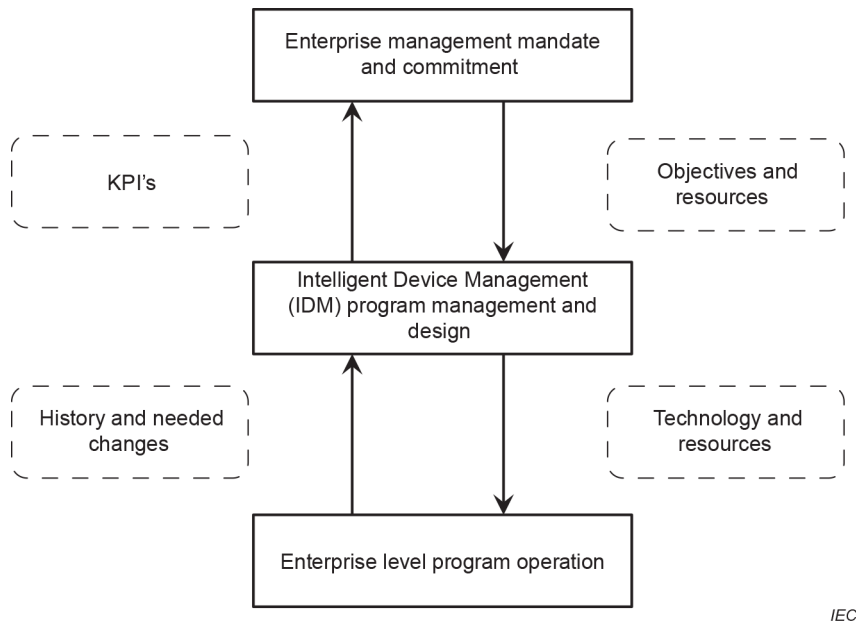
Figure 1 – IDM and intelligent device in the context of asset management

Asset management of the enterprise manages its assets. An intelligent device is one form of asset that is managed by IDM following the principles of asset management, as illustrated in Figure 1. Figure 1 and Figure 3, plus other explanatory IDM relationship figures are represented as UML class diagram in Annex B.

An overview and conventions of UML class diagrams are described in Annex A.

6.3.2 Positioning of IDM programs

Figure 2 shows the positioning of the IDM program in the context of enterprise business management and IDM work processes. An IDM program translates mandates and objectives provided by higher levels of the organization such as business management processes into requirements of technology and resources then passes them to IDM work processes. Similarly, the IDM program translates performance history recorded by work processes into KPIs and passes them to higher or other levels of the organization.

**Key**

Arrows represent information flow.

Dashed and rounded boxes indicate typical information being transferred.

NOTE IDM program translates mandates and objectives, coordinates business, engineering, operation, and maintenance.

Figure 2 – Positioning of IDM program

Implementation methods for enterprise business management are non-technical and a function of each enterprise's operating practices. Many enterprise business management stakeholders can have an impact on the success of IDM. Most enterprise business management processes are created for larger purposes and are not structured to IDM work processes directly. A technical and business focus for IDM and a mid-level management structure that can focus on IDM can provide valuable coordination between the IDM work processes and higher-level management.

IDM programs are implemented and supported via IDM work processes. The IDM program requires a well-defined functional structure, but the structure can be tailored to the enterprise's needs.

6.3.3 Structure of IDM activities

IDM activities include enterprise level IDM activities, which are common to facilities of the enterprise. This relationship is shown for activities in Figure 3 and functions in Figure 4.

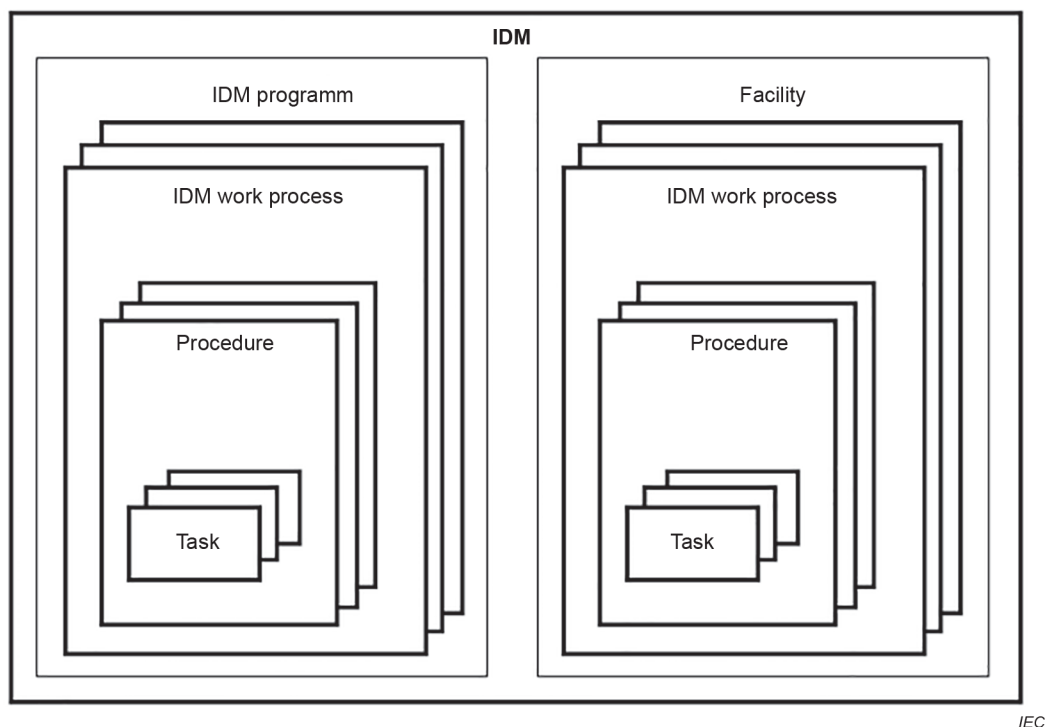


Figure 3 – Structure of IDM activities

6.4 Developing and maintaining IDM program

6.4.1 Overview

Some of the attributes of an IDM program are:

- the scope and boundary limits of an IDM program can change at any time;
- the process that creates an IDM program and the IDM program itself never ends;
- continuous development is normal for an enterprise program; and
- an enterprise program can create or utilize projects, but a project cannot create an IDM program.

An IDM program is one type of enterprise program. An IDM program consists of intangible assets such as ideas, concepts, and intellectual property.

Enterprise programs are management tools. Enterprise programs can allow sufficient management and technical focus to coordinate multiple organizations and activities inside an enterprise and external to the enterprise. The participating organizations can have competing goals in addition to common goals. An enterprise program can provide means to resolve these competing goals and coordinate common goals for maximum effectiveness.

An IDM program provides a convenient terminology or set of names and model for the enterprise and facility level IDM activities that can make IDM work as planned. However, IDM programs can be very different from one enterprise to the next. IDM can be a separate identified management activity in one enterprise, and part of a more diverse program in another enterprise. The structure will work most effectively if it is customized to fit the management style and resource deployment in an enterprise.

6.4.2 IDM program structure

The IDM program is developed from a preliminary concept from which a clearly documented management mandate and commitment can be obtained. The mandate and commitment provide the basis for the management and technical focus necessary for efficient and effective management of intelligent devices.

Both an organizational structure and a functional structure are determined as a basis of IDM program implementation which are compared against the mandate, revised as necessary, then input to improve the IDM program design.

A functional IDM program structure is illustrated in Figure 4.

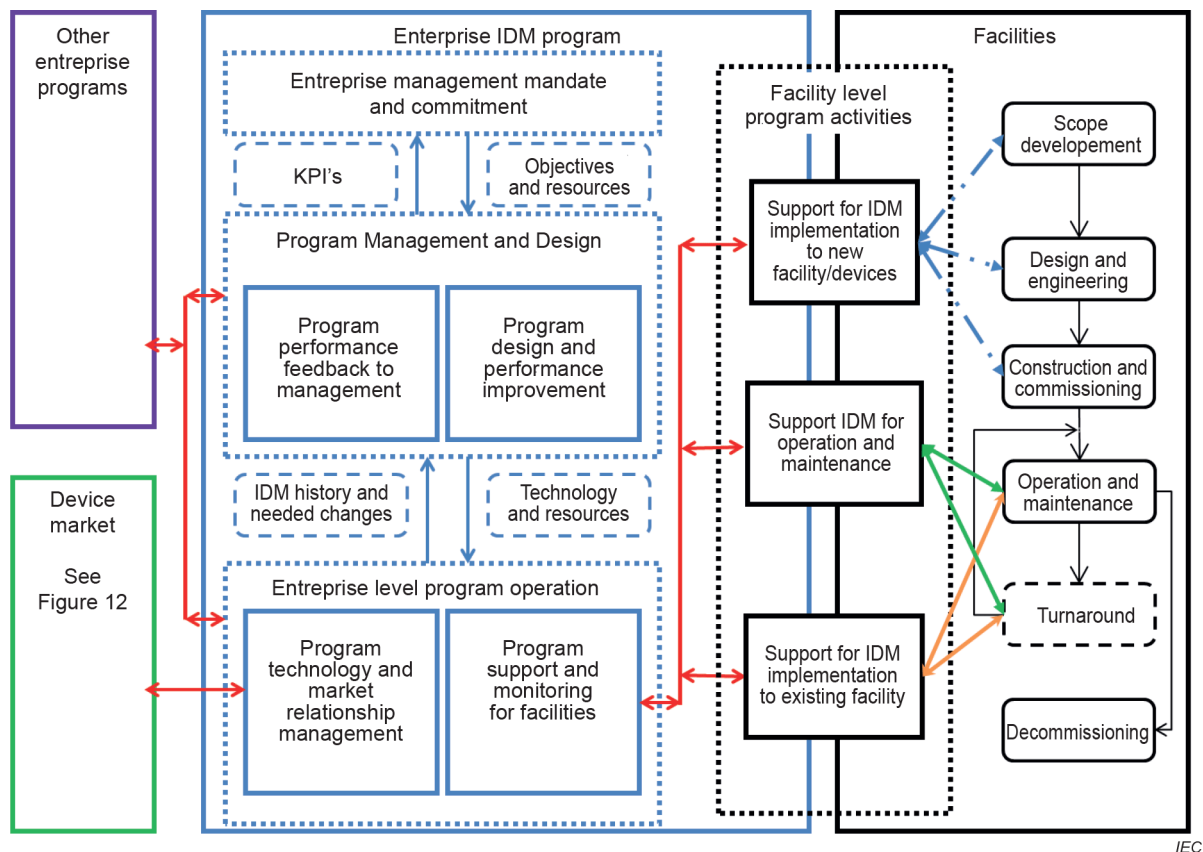


Figure 4 – An example of IDM program functional structure

The IDM program functional structure shown in Figure 4 is for reference only and represents functions, information exchange, and relationships that are a part of the formal processes for IDM.

6.4.3 IDM program life cycle

6.4.3.1 IDM program phases

Programs can be developed to meet an anticipated need or to address an existing need. IDM programs address mostly existing needs.

IDM activities are in use by an enterprise from the time that the first intelligent device is evaluated for use, until the time that the last intelligent device is removed from service. Removing the last intelligent device from service is not anticipated in the normal course of events.

When intelligent devices are first used, the devices are normally evaluated and supported by highly qualified personnel familiar with new technology. Only a few devices are in use, and ad-hoc work processes and procedures are often used.

When the technology has matured, many different types of devices can be in use in many diverse applications. Critical skills for support can be in short supply, and the aging devices will eventually require updating or replacement with newer technology. The processes for the initial use of new technology will become inefficient and ineffective, for support of mature technology. Formal processes that can apply across an enterprise can save money, lower risk, and simultaneously improve performance. An IDM program is a natural outcome of efforts to make use of formal processes to manage intelligent devices.

When developing an IDM program, some up-front work can identify enterprise goals and needs. This will evolve into an operation phase as the IDM program develops. In the operation phase, some implementation work will be necessary at the enterprise level and at the facility level. The exact nature of the starting point, end point, and evolution will depend on the enterprise.

There is no set formula for IDM program development. However, some general principles will identify common steps in the process. The development steps presented below are logical steps. These steps can overlap in time, and the development is often iterative.

A simplified model for an IDM program is shown in Figure 5. This model is accurate for cases where an IDM program is established to meet an anticipated need or when the IDM program is established after a need is revealed through issues with an installed base.

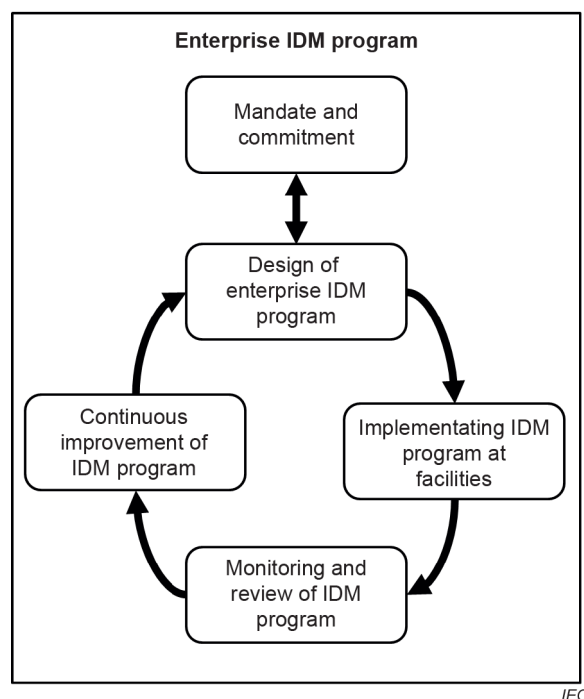


Figure 5 – IDM program life cycle phases

Figure 5 shows the continuous improvement "Plan-Do-Check-Act" process that is crucial to IDM program success. Continuous improvement is necessary to manage change inherent to the underlying technology and the long timespan for facility installations.

6.4.3.2 Goals scope and objectives

When an enterprise decides to move to formal IDM work processes and procedures, the first step is documenting the goals, scope, and objectives:

- goals give guidance on future direction and provide motivation;
- scope identifies boundary conditions and can be used to develop external interfaces; and
- objectives provide measurable targets that can be used to measure success and identify unmet needs.

The goals, scope, and objectives will need to be periodically reviewed and updated as conditions change.

6.4.3.3 Gaps, opportunities, and priorities

With a clear mandate, a first step in IDM program development is often assessment and gap analysis. Assessment can include:

- technology installed base;
- future technology development;
- tools for managing the technology;
- skill resources; and
- other enterprise programs, technical, or management focus areas that impact IDM.

The outcome following assessment and gap analysis is identification of opportunities and a prioritization process to design the IDM program. The prioritization is generally based on opportunities for cost saving and risk reduction.

Enterprises are rarely homogeneous. Some parts of the enterprise can have more extensive gaps than others, and the impact of those gaps can be different across the enterprise.

Strategic and tactical decisions are needed before the IDM program can start. The gap analysis forms the basis for IDM program development, planning, and implementation.

6.4.3.4 Plans, resources, and organization

During the planning step in IDM program formation, some temporary technical and management staffing can be required. This could involve research and development for identified technical gaps or tool development and establishment of external supply relationships to meet the long term needs for technology and personnel.

As plans, technology, and work processes become available, field trials can be useful in testing IDM program operation before more widespread roll out. The field trial phase can identify areas for further development as well as help to quantify the benefits of formal IDM processes.

Strategic decisions are needed for IDM program support and tools to serve the needs of facilities. These strategic decisions are not easy to change as they drive long term support optimization and set fixed cost budgets. These decisions on support and tools also affect enterprise and facility organization structure.

Common support options include:

- support within a facility;
- support within a group of facilities with a common location or business group;
- support at an enterprise level; and
- combinations of the above.

The above support options can utilize a combination of:

- in-house permanent staff;
- contracted or temporary assistance; and
- support provided by device suppliers.

Decisions about support do not need to be the same for every location or group of facilities in an enterprise. They are often tailored to the type of facility and local conditions. An enterprise program can incorporate a variety of support strategies and still offer all benefits expected of the IDM program.

A long-term support strategy needs to be defined during scope development. A major decision for IDM planning is the amount and type of dedicated resources that are deployed at the facility. Many facilities cannot support full time local resources for every skill or function necessary for long term support of the facility.

Remote monitoring centers can be established for monitoring of assets to assist local resources. IDM can support remote monitoring since diagnostics can be collected and analysed remotely. Use of remote support needs a cooperative local and remote support structure with clear roles and responsibilities for each. This structure also requires significant enterprise infrastructure and personnel resources to be able to monitor devices securely from a remote location. Decisions about local and remote support will have an impact on how the IDM program is designed as well as the work processes to support IDM.

6.4.3.5 IDM program operation

After the project has been completed and turned over to operations, the IDM program enters the longest life cycle phase associated with ongoing operations. Unfortunately, the technologies associated with IDM do not remain stagnant and therefore continuous monitoring of the effectiveness of the IDM program is critical to success.

Important components of IDM program operations and monitoring include:

- support staff training;
- metrics; and
- ongoing communication with all stakeholders (user, supplier, enterprise experts, etc.).

Effective implementation of the above provides the information necessary for the IDM program's continuous improvement.

Using the information gathered from KPI's and related metrics obtained from the IDM monitoring program lays the groundwork on which continuous program improvements can be made.

Sharing information between and across facilities as well as the enterprise leads to development of best practices that can be implemented in the next IDM program renewal cycle.

6.5 Supplier management

6.5.1 Coordination with suppliers

Changes in device technology and device model revisions can be disruptive to IDM in a facility and to implementation in projects. Management of these changes requires cooperative efforts between users and suppliers. This effort is a significant part of an IDM program.

6.5.2 Intelligent device life cycle management

IDM is an integral part of multiple life cycles of an enterprise. This Subclause 6.5.2 describes four life cycles and the relationship of IDM to these life cycles. The four life cycles are overlapping and interdependent. This is typical of enterprise life cycles that are incorporated into an enterprise program. The four life cycles are:

- IDM program life cycle;
- facility life cycle;
- device life cycle; and
- device technology life cycle.

The IDM program life cycle can cover the life cycles of multiple facilities as shown in Figure 6.

NOTE 1 IACS is considered a device in this life cycle.

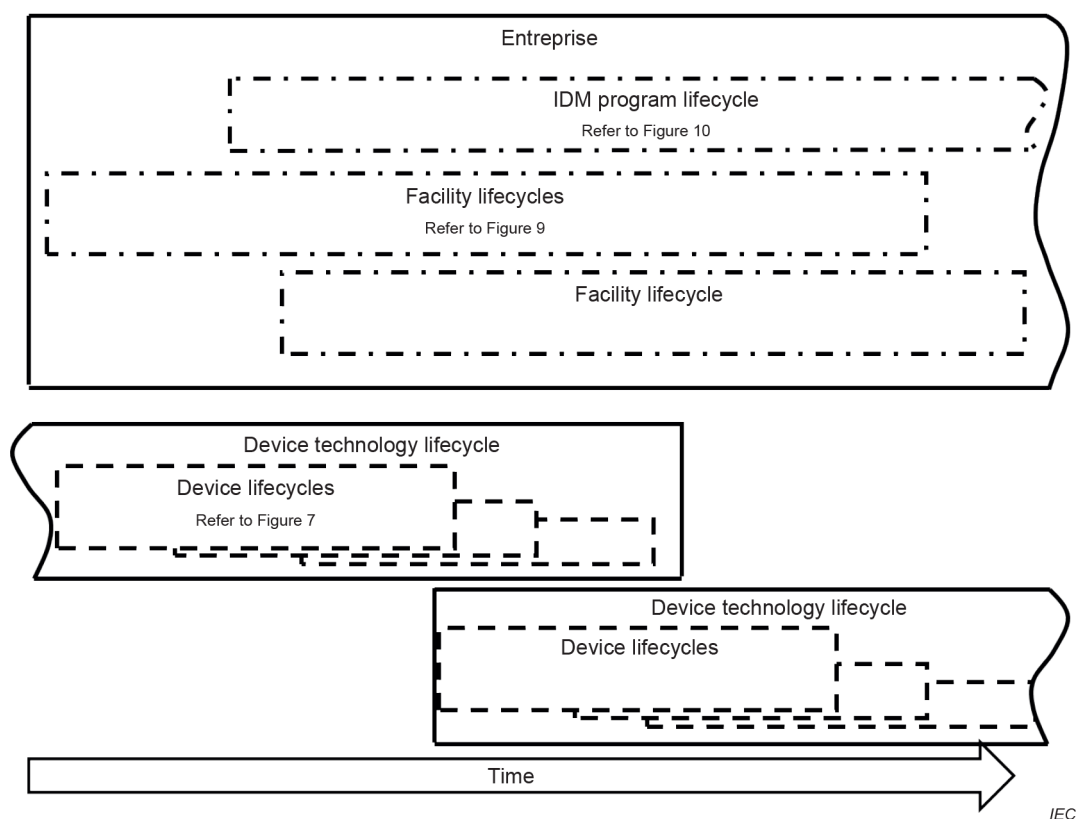


Figure 6 – Timing relationship between life cycles

In practice, the IDM program can be initiated after a facility is already in the operation phase of its life cycle. Implementation of IDM can be introduced in operating facilities to synchronize existing work processes and establish needed structures. Establishing IDM in an operating facility is challenging and is often beyond the capability of a facility's engineering and maintenance personnel.

While this document illustrates an efficient and mostly linear process for new facilities, most enterprises can modify this to meet the needs of their existing facilities. The end result is very similar, but the implementation can be modified to match the starting point for each facility. For instance, most existing facilities have intelligent devices installed, but they might not have these devices connected to monitoring systems. Small facility implementation projects can rectify gaps in installed monitoring systems so that work processes can be put in place and an IDM program can be established. For these facilities, an audit of installed base capability and deficiency starts as a basis for scope development.

Another structural modification can be done by enterprises that operate a single facility. For these enterprises, the IDM program life cycle and facility life cycle can be the same.

An IDM program requires investment in enterprise infrastructure regardless of whether it is installed in a single facility or across the enterprise. IDM enterprise infrastructure can be shared and integrated with other enterprise programs.

The shortest of the four IDM life cycles is typically the device life cycle. Normally, device life cycles come in releases or model changes that allow migration from one model to the next. However, the entire series of models is typically shorter than the life of a facility.

A device life cycle consists of phases as listed below and shown in Figure 7:

- device development phase;
- device sales phase;
- after-sales support phase; and
- obsolete phase.

NOTE 2 The device life cycle represents the life cycle of a device type. The details are specified in IEC 62890.

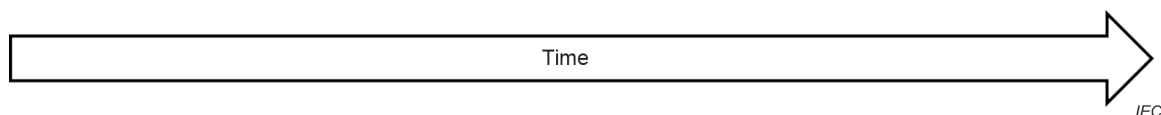
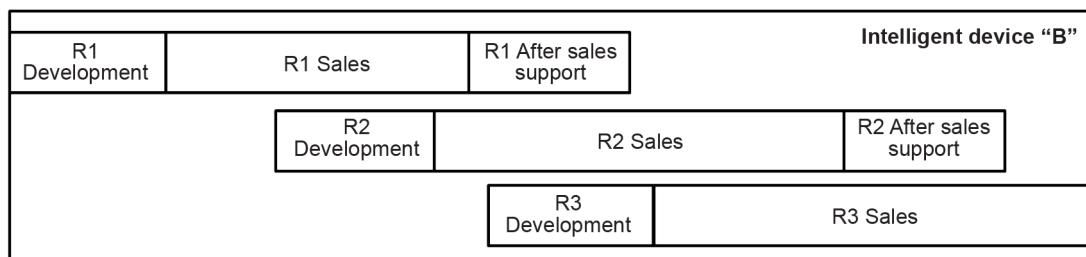
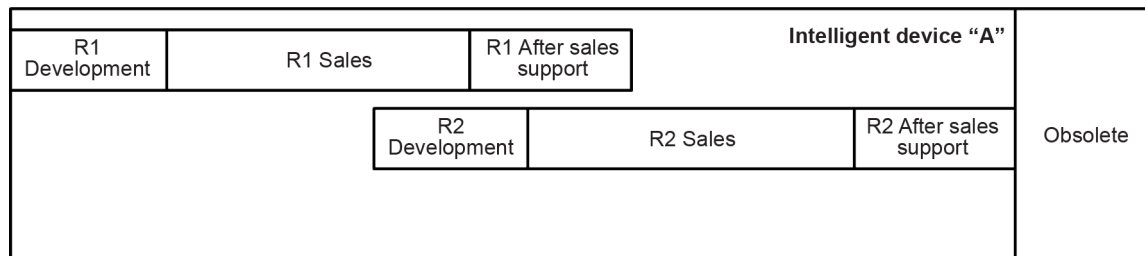


Figure 7 – Timing relationship between device life cycles

Intelligent devices are built with a wide variety of features and options in addition to their basic function. While the additional features provide value, they also add complexity and preclude interchangeability. These devices generally do conform to some standards and have some level of interoperability, but the added features require additional management. Each intelligent device requires the use of software and/or metadata components and therefore revision management is an example of an additional management requirement.