INTERNATIONAL STANDARD

ISO 8000-64

First edition
2022-05

Data quality —

Part 64: Data quality management: Organizational process maturity assessment: Application of the Test Process Improvement method

Qualité des données —

Partie 64: Gestion de la qualité des données : Évaluation de la maturité des processus organisationnels : Application de la méthode d'amélioration des processus de test (TPI, Test Process Improvement)

Reference number
ISO 8000-64:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

A list of all parts in the ISO 8000 series can be found on the ISO website.

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

Digital data deliver value by enhancing all aspects of organizational performance including:

— operational effectiveness and efficiency;

— safety;

— reputation with customers and the wider public;

— compliance with statutory regulations;

— innovation;

— consumer costs, revenues and stock prices.

In addition, many organizations are now addressing these considerations with reference to the United Nations Sustainable Development Goals[1)].

The influence on performance originates from data being the formalized representation of information[2)]. This information enables organizations to make reliable decisions. This decision making can be performed by human beings directly and also by automated data processing including artificial intelligence systems.

Through widespread adoption of digital computing and associated communication technologies, organizations become dependent on digital data. This dependency amplifies the negative consequences of lack of quality in these data. These consequences are the decrease of organizational performance.

The biggest impact of digital data comes from two key factors:

— the data having a structure that reflects the nature of the subject matter;

EXAMPLE 1 A research scientist writes a report using a software application for word processing. This report includes a table that uses a clear, logical layout to show results from an experiment. These results indicate how material properties vary with temperature. The report is read by a designer, who uses the results to create a product that works in a range of different operating temperatures.

— the data being computer processable (machine readable) rather than just being for a person to read and understand.

EXAMPLE 2 A research scientist uses a database system to store the results of experiments on a material. This system controls the format of different values in the data set. The system generates an output file of digital data. This file is processed by a software application for engineering analysis. The application determines the optimum geometry when using the material to make a product.

ISO 9000 explains that quality is not an abstract concept of absolute perfection. Quality is actually the conformance of characteristics to requirements. This actuality means that any item of data can be of high quality for one purpose but not for a different purpose. The quality is different because the requirements are different between the two purposes.

EXAMPLE 3 Time data are processed by calendar applications and also by control systems for propulsion units on spacecraft. These data include start times for meetings in a calendar application and activation times in a control system. These start times require less precision than the activation times.

The nature of digital data is fundamental to establishing requirements that are relevant to the specific decisions that are made by each organization.

EXAMPLE 4 ISO 8000-1 identifies that data have syntactic (format), semantic (meaning) and pragmatic (usefulness) characteristics.

1) https://sdgs.un.org/goals

2) ISO 8000-2 defines information as “knowledge concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning”.

To support the delivery of high-quality data, the ISO 8000 series addresses:

— data governance, data quality management and maturity assessment;

EXAMPLE 5 ISO 8000-61 specifies a process reference model for data quality management.

— creating and applying requirements for data and information;

EXAMPLE 6 ISO 8000-110 specifies how to exchange characteristic data that are master data.

— monitoring and measuring information and data quality;

EXAMPLE 7 ISO 8000-8 specifies approaches to measuring information and data quality.

— improving data and, consequently, information quality;

EXAMPLE 8 ISO/TS 8000-81 specifies an approach to data profiling, which identifies opportunities to improve data quality.

— issues that are specific to the type of content in a data set.

EXAMPLE 9 ISO/TS 8000-311 specifies how to address quality considerations for product shape data.

Data quality management covers all aspects of data processing, including creating, collecting, storing, maintaining, transferring, exploiting and presenting data to deliver information.

Effective data quality management is systemic and systematic, requiring an understanding of the root causes of data quality issues. This understanding is the basis for not just correcting existing nonconformities but for also implementing solutions that prevent future reoccurrence of those nonconformities.

EXAMPLE 10 If a data set includes dates in multiple formats including “yyyy-mm-dd”, “mm-dd-yy” and “dd-mm-yy”, then data cleansing can correct the consistency of the values. Such cleansing requires additional information, however, to resolve ambiguous entries (such as, “04-05-20”). The cleansing also cannot address any process issues and people issues, including training, that have caused the inconsistency.

As a contribution to this overall capability of the ISO 8000 series, this document specifies a procedure by which any organization can assess process maturity according to the specific priorities of the organization. This procedure provides a capability to assess and improve data quality management processes. The procedure makes use of the Test Process Improvement method[11][12][3)].

Organizations can use this document on its own or in conjunction with other parts of the ISO 8000 series.

This document supports activities that affect:

— one or more information systems;

— data flows within the organization and with external organizations;

— any phase of the data life cycle.

By implementing parts of the ISO 8000 series to improve organizational performance, an organization achieves the following benefits:

— objective validation of the foundations for digital transformation of the organization;

— a sustainable basis for data in digital form becoming a fundamental asset class the organization relies on to deliver value;

— securing evidence-based trust from other parties (including supply chain partners and regulators) about the repeatability and reliability of data and information processing in the organization;

3) Numbers in square brackets refer to entries in the Bibliography.

— portability of data with resulting protection against loss of intellectual property and reusability across the organization and applications;

— effective and efficient interoperability between all parties in a supply chain to achieve traceability of data back to original sources;

— readiness to acquire or supply services where the other party expects to work with common understanding of explicit data requirements.

ISO 8000-1 provides a detailed explanation of the structure and scope of the whole ISO 8000 series.

ISO 8000-2[4)] specifies the single, common vocabulary for the ISO 8000 series. This vocabulary is ideal reading material by which to understand the overall subject matter of data quality. ISO 8000-2 presents the vocabulary structured by a series of topic areas (for example, terms relating to quality and terms relating to data and information).

Annex A of this document contains an identifier that conforms to ISO/IEC 8824-1. The identifier unambiguously identifies this document in an open information system.

4) The content is available on the ISO Online Browsing Platform. https://www.iso.org/obp

Data quality —

Part 64:
Data quality management: Organizational process maturity assessment: Application of the Test Process Improvement method

1 Scope

This document specifies how to apply the Test Process Improvement method to the assessment of organizational process maturity. This document refines the language in the method, which has an original purpose of more than just data quality management. This document supports improving data quality management when an organization uses the process reference model in ISO 8000-61 as the foundation for specifying the measurement goals for the process measurement necessary when performing maturity assessment.

The following are within scope of this document:

— the relationship between the Test Process Improvement method[11][12] and the procedure for assessing process maturity of data quality management as specified by ISO 8000-61;

— the role of process measurement in accordance with ISO 8000-63 when performing assessment of process maturity;

— the outputs from the procedure.

The following are outside the scope of this document:

— the purpose, outcomes and activities of processes for data quality management;

— specific content for the scope of individual quality management areas, the maturity levels and the maturity level targets;

— specific content for each inspection order including the frequency of inspection points;

— instructions on how to develop a process improvement strategy in response to the outputs of the procedure.

This document can be used in conjunction with or independently of quality management systems standards.

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 8000-2, *Data quality — Part 2: Vocabulary*

ISO 8000-61, *Data quality — Part 61: Data quality management: Process reference model*

ISO 8000-63, *Data quality — Part 63: Data quality management: Process measurement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8000-2 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/

4 Process maturity assessment

This document specifies a procedure for assessing process maturity. This procedure builds on the requirements for process measurement specified by ISO 8000-63. The procedure provides a flexible approach to meet the requirements of an organization using the procedure. This flexibility is from the organization being able to define quality management areas that depend on the factors identified by the organization as being most relevant when seeking to improve process maturity.

EXAMPLE 1 ISO/IEC 33020 differs from this document by specifying a fixed set of process attributes for use in maturity assessment.

EXAMPLE 2 An organization chooses to make each quality management area correspond to the responsibilities of a single role within the organization.

Each quality management area covers one or more measurement goals that are the basis for process measurement supporting the maturity assessment. The assessment enables an organization to drive progressive improvement of process maturity but does not establish a general benchmark for use by the organization to compare itself with other organizations.

EXAMPLE 3 Two organizations define different quality management areas and, therefore, are unable directly to compare the results from assessing process maturity.

The procedure highlights those quality management areas that have yet to reach the required target for overall process maturity to reach the next level. These quality management areas become the focus for improvement.

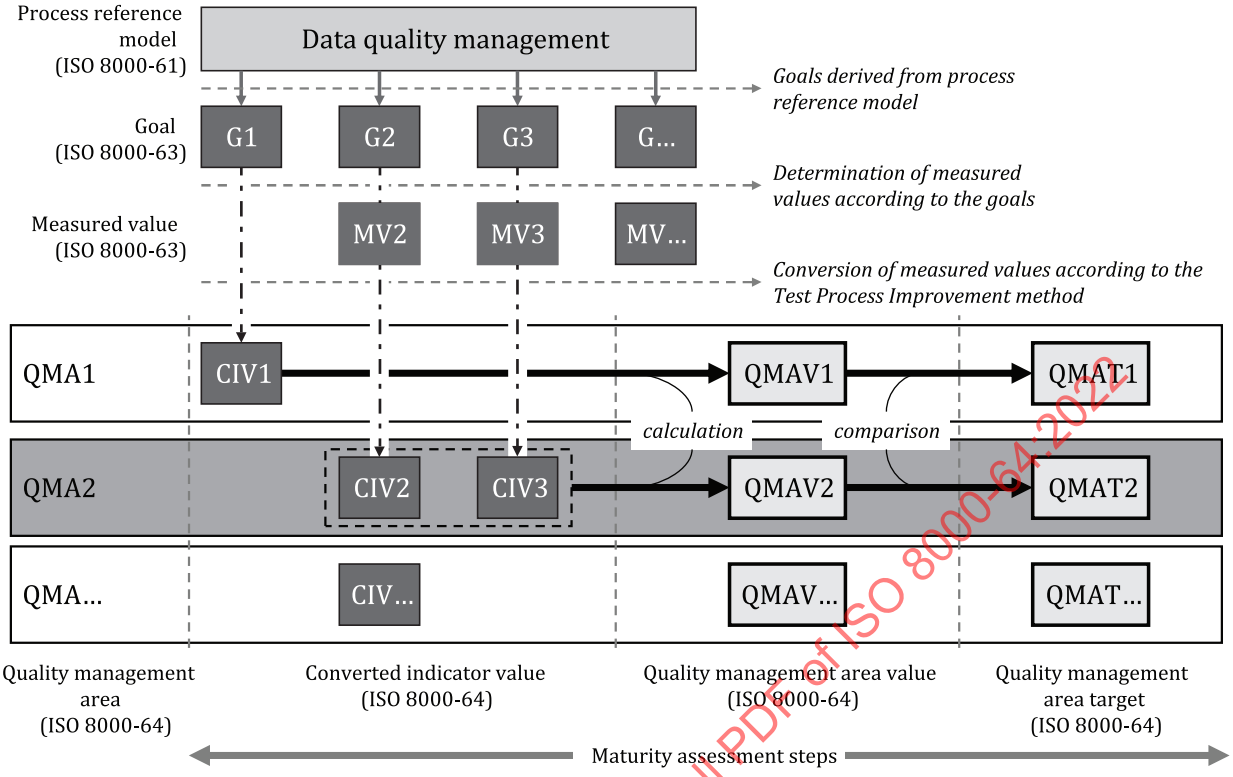
The initial steps of the procedure set up the organization to be able to perform maturity assessment. This set up shall include, in accordance with ISO 8000-63, creating an inspection plan for the process measurement. The organization can then proceed to use the rest of the procedure to perform assessments at appropriate frequencies to track the evolution of maturity.

EXAMPLE 4 An organization creates an inspection plan and then decides to assess process maturity every six months.

To establish a basis for improving data quality management (see Figure 1), the process maturity assessment shall:

— assess implementations of processes specified by ISO 8000-61;

— execute the procedure as specified by Clause 5.



Key

CIV1, CIV2 etc.	converted indicator values
G1, G2 etc.	goals
MV2, MV3 etc.	measured values
QMA1, QMA2 etc.	quality management areas
QMAT1, QMAT2 etc.	quality management area targets
QMAV1, QMAV2 etc.	quality management area values

Figure 1 — Process measurement and process maturity assessment

5 Procedure for maturity assessment

5.1 Foundations and steps of the procedure

The procedure in this document takes account of three elements of the Test Process Improvement method[11][12] (see Table 1).

Table 1 — Relationship between the Test Process Improvement method and the procedure for maturity assessment

Test Process Improvement element	Equivalent in the procedure
key areas	quality management areas
scale	maturity levels
common metric for key areas	metric for quality management areas

The procedure consists of the following steps:

— step 0, prepare core assessment elements (see 5.2);

— step 1, define quality management areas (see 5.3);

— step 2, define maturity levels (see 5.4);

— step 3, define maturity level targets (see 5.5);

— step 4, define inspection plan (see 5.6);

— step 5, prepare and apply inspection order (see 5.7);

— step 6, generate quality management area values (see 5.8);

— step 7, identify the maturity level improvement requirement (see 5.9).

These steps generate a series of outputs that capture the key information by which to understand the progress of process maturity in an organization (see Table 2).

EXAMPLE Annex B provides an example of performing a process maturity assessment using the procedure.

Table 2 — Outputs of the procedure for maturity assessment

Step number	Output identifier	Output label
1	T1 (see Table 3)	Quality management area mapping
3	T2 (see Table 4)	Target level matrix
4	T3 (see Table 5)	Inspection plan
5	T4 (see Table 6)	Inspection order results
	T5 (see Table 7)	Inspection history (measured values)
	T6 (see Table 8)	Inspection history (converted values)
6	T7 (see Table 9)	Quality management area values
	T8 (see Table 10)	Inspection history (quality management area values)
7	T9 (see Table 11)	Improvement requirement

5.2 Prepare core assessment elements (procedure step 0)

This step consists of the following:

— defining a common metric that conforms with ISO 8000-63 and that is applicable to all converted indicator values and all quality management area values;

— defining the combination function that will generate a quality management area value when the corresponding quality management area maps to more than one measurement goal.

EXAMPLE The metric: "A" | "B" | "C" | "D".

NOTE This expression of the metric conforms with ISO/IEC 14977.

5.3 Define quality management areas (procedure step 1)

This step consists of the following:

— defining the quality management areas for inspection;

— for each quality management area, identifying one or more measurement goals that conform with ISO 8000-63.

Each quality management area covers a process scope relevant to the objectives of the organization that is applying the procedure. These objectives cover the intentions with respect to improving process maturity to deliver benefit to the organization.

This step generates output T1 that captures the quality management area mapping (see Table 3).

Table 3 — Example layout and content for output T1, quality management area mapping

Measurement goal	Quality management area
G01	QMA01
G02	QMA02
G03	
G04	QMA03
...	...

5.4 Define maturity levels (procedure step 2)

This step consists of defining a set of maturity levels, which are a continuous range of integers starting at 1 (the lowest level).

5.5 Define maturity level targets (procedure step 3)

This step consists of the following:

— for each combination of quality management area (see 5.3) and maturity level (see 5.4), defining the metric value (see 5.2) that is the target;

— for each quality management area, ensuring each target is not lower than the target for the next lowest maturity level;

— optionally, defining maturity level categories, each of which uses a label to describe a sub-set of the levels[11].

EXAMPLE A set of maturity level categories consists of "controlled" (maturity levels ML01 and ML02), "efficient" (ML03 and ML04) and "optimized" (ML05 and ML06) (see Table 4).

This step generates output T2 that captures the target level matrix (see Table 4).

Table 4 — Example layout and content for output T2, target level matrix

Quality management area	Maturity levels					
	Controlled		Efficient		Optimized	
	ML01	ML02	ML03	ML04	ML05	ML06
QMA1	A	B	B	C	C	C
QMA2	A	A	A	A	B	C
QMA3	A	A	B	B	B	C
...	...	...	...	...	...	...

5.6 Define inspection plan (procedure step 4)

To define an inspection plan that conforms with ISO 8000-63, this step consists of the following:

— for each goal identified by performing step 1 of the procedure (see 5.3), defining one question that conforms with ISO 8000-63;

— for each question, defining one indicator that conforms with ISO 8000-63;

— for each indicator, either defining a distinct measurement scale for the measured indicator value or specifying to use the common metric for the assessment (see 5.2);

— for each indicator that has a distinct measurement scale, defining the value assessment rule that conforms with ISO 8000-63 (this rule converts the measured indicator value into the converted indicator value).

This step generates output T3 that captures the inspection plan (see Table 5).

Table 5 — Example layout and content for output T3, inspection plan

Goal	Indicator	Measurement scale	Value assessment rule (where Mn is the measured value for the corresponding indicator)
G01	I01	"N" | "Y"	*f1*(M01)
G02	I02	1 | 2 | 3	*f1*(M02)
G03	I03	0 to 100 %	*f1*(M03)
...	...	...	...

5.7 Prepare and apply inspection order (procedure step 5)

To generate converted indicator values by preparing and applying an inspection order, this step consists of the following:

— identifying the need for a series of inspection points;

— for each inspection point, preparing an inspection order that conforms to ISO 8000-63 and that uses the inspection plan created by step 4 of the procedure (see 5.6);

— for each inspection order, measuring the constituent indicator values;

— for each measured indicator value, applying the applicable value assessment rule to generate the converted indicator value.

This step generates:

— output T4 that captures the inspection order results (see Table 6);

— output T5 that captures the inspection history in terms of the measured indicator values (see Table 7);

— output T6 that captures the inspection history in terms of the converted indicator values (see Table 8).

Table 6 — Example layout and content for output T4, inspection order results

Indicator	Measured value	Converted value
I01	Y	C
I02	2	B
I03	70 %	C
...	...	...

Table 7 — Example layout and content for output T5, inspection history (measured values)

Indicator	Inspection point				
	IP1	IP2	IP3	IP4	...
I01	N	N	Y	Y	...
I02	1	2	1	2	...
I03	30 %	35 %	50 %	70 %	...

Table 7 *(continued)*

Indicator	Inspection point				
	IP1	IP2	IP3	IP4	...
...	...	...	...	...	...

Table 8 — Example layout and content for output T6, inspection history (converted values)

Indicator	Inspection point				
	IP1	IP2	IP3	IP4	...
I01	A	A	C	C	...
I02	A	B	A	B	...
I03	A	A	B	C	...
...	...	...	...	...	...

5.8 Generate quality management area values (procedure step 6)

This step consists of, for each combination of inspection point (see 5.7) and quality management area (see 5.3), taking the one or more corresponding converted indicator values (see 5.7) either (if the quality management area maps to more than one measurement goal) to apply the applicable combination function (see 5.2) to generate the corresponding quality management area value or to use the converted indicator value as the quality management area value.

This step generates:

— output T7 that captures the quality management area values for an individual inspection point (see Table 9);

— output T8 that captures the inspection history in terms of a series of quality management area values (see Table 10).

Table 9 — Example layout and content for output T7, quality management area values

Quality management area	Goal	Inspection point		
		IP4		
		Converted indicator value	Combination function	Quality management area value
QMA01	G01	C	n/a	C
QMA02	G02	B	min (G02, G03)	B
	G03	C		
QMA03	G04	C	n/a	C
...	...	...	...	...

Table 10 — Example layout and content for output T8, inspection history (quality management area values)

Quality management area	Inspection point				
	IP1	IP2	IP3	IP4	...
QMA01	A	A	C	C	...
QMA02	A	B	A	B	...
QMA03	A	A	B	C	...
...	...	...	...	...	...

5.9 Identify the maturity level improvement requirement (procedure step 7)

This step consists of the following:

— for each inspection point (see 5.7), creating a set of achieved levels that are the highest maturity level at which each quality management area value (see 5.8) meets the applicable quality management area target (see 5.5);

— for each set of achieved levels, identifying the achieved maturity level, which is the lowest value in the set;

— for each combination of inspection point (see 5.7) and quality management area (see 5.3), identifying the applicable maturity level target (see 5.5) for the next maturity level after the achieved maturity level;

— to determine the improvement requirement for each inspection point, identifying which quality management area values (see 5.8) are yet to meet the applicable maturity level target for the next maturity level after the achieved maturity level.

This step generates output T9 that captures the improvement requirement (see Table 11).

EXAMPLE On the basis of the maturity assessment at inspection point IP4, the organization will not reach maturity level ML06 without improving quality management area QMA2 from a value of "B" to a value of "C" (see Table 11).

Table 11 — Example layout and content for output T9, improvement requirement

Quality management area	Achieved maturity level	Inspection point	Next maturity level
	ML05	IP4	ML06
QMA1	C	C	C
QMA2	B	B	C
QMA3	B	C	C
…	…	…	…

5.10 Applying the procedure to data quality management processes

By taking the goals from the processes in ISO 8000-61, an organization can assess the maturity of data quality management (see Figure 2).

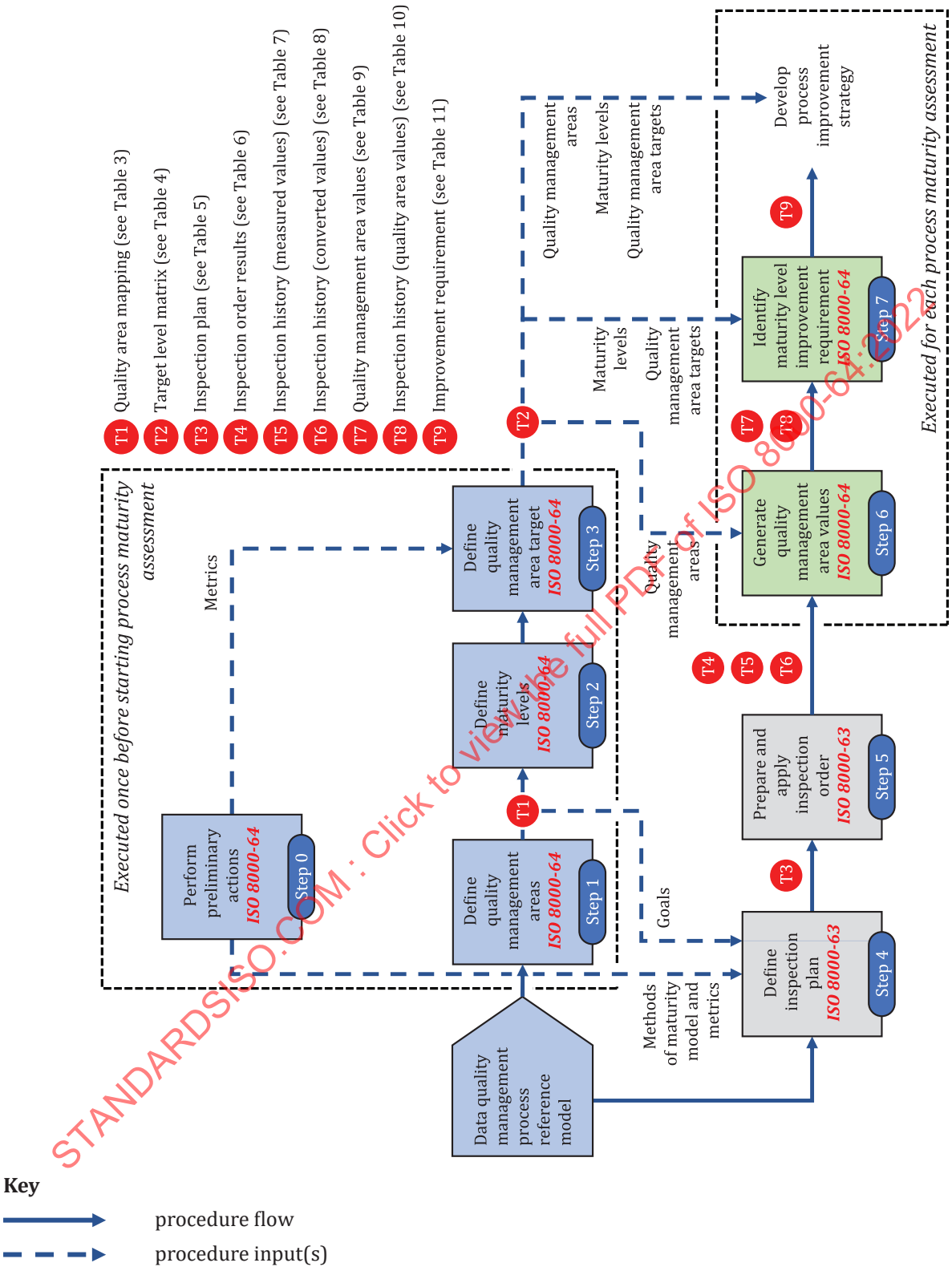


Figure 2 — Process maturity assessment for data quality management

Annex A
(informative)

Document identification

To provide for unambiguous identification of an information object in an open system, the following object identifier is assigned to this document. The meaning of this value is defined in ISO 10303-1.

```
{ iso standard 8000 part(64) version(1) }
```

Annex B
(informative)

Example process maturity assessment

This annex shows an example process maturity assessment for the data quality strategy management process specified by ISO 8000-61 (see Table B.1). This assessment consists of the following steps:

— step 0, prepare core assessment elements (see Table B.2);

— step 1, define quality management areas (see Table B.3);

— step 2, define maturity levels;

— step 3, define maturity level targets (see Table B.4);

— step 4, define inspection plan;

— step 5, prepare and apply inspection order (see Table B.5 and Table B.6);

— step 6, generate quality management area values (see Table B.7);

— step 7, identify the maturity level improvement requirement (see Table B.8).

Table B.1 — Example measurement stack for data quality strategy management

Process:	Data quality strategy management (see ISO 8000-61:2016, 6.2.3)						
Purpose:	The purpose of data quality strategy management is to establish the basis on which subsequently to develop policies, standards, procedures and implementation plans that apply to data quality management across the organization and that align with strategic intentions for data quality.						
Goal:	G1	Top management is committed to the improvement of data quality to agreed levels at the organizational level.					
Sub goal:	S1.1	Clear definition of the commitment.					
Question			**Indicator**		**Metric**		
Q1.1.1	Who defines the commitment?		I1.1.1	Name of author existing (0 .. 100 %)	M1.1.1	%	
Q1.1.2	Where is the commitment defined?		I1.1.2	Location of commitment known (0 .. 100 %)			
Sub goal:	S1.2	Clear definitions of responsibilities.					
Question			**Indicator**		**Metric**		
Q1.2.1	Are there any responsibilities?		I1.2.1	Degree of responsibility	M1.2.1	%	
Goal:	G2	A data quality strategy is created, describing the vision, long-term goals, an implementation roadmap and short-term objectives, which are defined in terms of quantitative outcomes.					
Sub goal:	S2.1	Clear definition of the data quality strategy.					
Question			**Indicator**		**Metric**		
Q2.1.1	What is meant by data quality?		I2.1.1	Degree of qualification (educated user)	M2.1.1	%	
Q2.1.2	What should a data quality strategy contain?		I2.1.2	Degree of fulfilment (management manual, internal auditing)			
Sub goal:	S2.2	Clear description of the vision for the data quality strategy.					
Question			**Indicator**		**Metric**		