
**Systems and software engineering —
Information technology project
performance benchmarking
framework —**

**Part 4:
Guidance for data collection and
maintenance**

*Ingénierie des systèmes et du logiciel — Cadre de conduite de tests de
performance de projet de technologies de l'information —*

Partie 4: Directives pour la collecte de données et la maintenance



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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/IEC JTC1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

A list of all parts in the ISO/IEC 29155 series can be found on the ISO website.

Introduction

Benchmarking is an activity of comparing “objects of interest” to each other or against a benchmark to evaluate characteristic(s). In the context of the ISO/IEC 29155 series, the “object of interest” is the performance of information technology (IT) project, and the characteristic is a particular aspect of an IT project such as productivity.

Benchmarking is one of the fastest-growing techniques in the area of IT project management. Instances of IT project performance benchmarking are initiated and conducted for various reasons. Among the most common reasons are the following:

- a) the need to compare project productivity between similar industries;
- b) the need to compare productivity between different project types and technologies;
- c) the need to find the most effective targets for IT development process improvement;
- d) the need to compare productivity between different suppliers;
- e) the need to improve project management maturity;
- f) the need to improve project estimation capability.

Much has been written regarding the trials of establishing IT project performance benchmarking, and statistics bear witness to the high failure rate of measurement and benchmarking programs. The most probable causes for failure have been disappointment in the benchmarking outcomes due to a lack of alignment between the selected measurements and business goals, and the misunderstanding of project level measurements in relation to program and portfolio management levels. When there is no alignment between executed measurements and provided outcomes, unnecessary effort is required from the IT project teams collecting the project data. The result is decreased motivation to continue and institutionalize benchmarking.

As is shown in [Figure 1](#), the ISO/IEC 29155 series consists of multiple parts.

- ISO/IEC 29155-1 provides the overall framework model for IT project performance benchmarking. It consists of activities and components that are necessary to successfully identify, define, select, apply, and improve benchmarking.
- ISO/IEC 29155-2 prescribes the required tasks in individual benchmarking activities that are necessary to execute various activities to conduct and/or support successful benchmarking in an organization.
- ISO/IEC 29155-3 prescribes the guidance for reporting processes and contents of typical reports.
- ISO/IEC 29155-4 provides guidance for the activities to collect data of IT projects to be entered into and maintained in a benchmarking repository.

Further parts might follow.

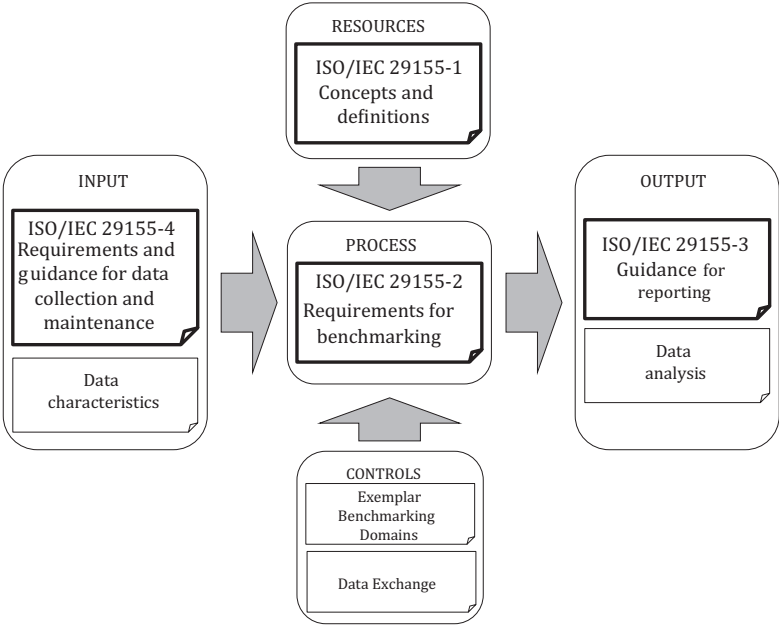


Figure 1 — IT project performance benchmarking standards overview

Systems and software engineering — Information technology project performance benchmarking framework —

Part 4: Guidance for data collection and maintenance

1 Scope

This document provides general requirements and guidance for collecting and maintaining data of information technology (IT) projects and for delivering the benchmarking repository within benchmarking activities of “the IT project performance benchmarking framework” by prescribing the following:

- a) requirements and guidance for data element definitions;
- b) requirements and guidance for the data collection and maintenance processes within the benchmarking framework;
- c) requirements and guidance for maintaining benchmarking repository product and issued benchmarks.

This document mainly focuses on three major activities, which are “maintain repository”, “submit IT project data”, and “measure IT project” activities.

This document is intended for use by stakeholder(s) of IT project performance benchmarking (e.g. benchmarking user, benchmark provider, benchmarking service provider, and IT project team).

NOTE The following are examples of how this document can be used:

- by a benchmark provider, to define data elements, collect and maintain IT project data, and provide benchmarking repository product or issued benchmarks;
- by a benchmarking analyst, to use benchmarking repository product and/or benchmarks for executing an instance of benchmarking;
- by a benchmarking service provider, to utilize benchmarking repository product and/or benchmarks for providing benchmarking services;
- by an IT service provider, to define data elements to be measured and/or to be submitted to repository owner.

It is out of the scope of this document to prescribe a particular set of data element definitions, formats or contents of the benchmarking repository.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29155-1, ISO/IEC 29155-2, and the following apply.

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

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

3.1

attribute

property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means

[SOURCE: ISO/IEC 15939:2007, 2.2]

3.2

data element

smallest unit of data of IT project

Note 1 to entry: Data element is usually implemented to be a data cell in a benchmarking repository and/or an “IT project data”.

Note 2 to entry: Data element is defined by a responsible person who plans data collection or benchmarking.

3.3

data record

defined group of related *data elements* (3.2), in which all the necessary data elements are included to represent *attributes* (3.1) of interest

Note 1 to entry: One data record usually corresponds to a specific IT project within IT project performance benchmarking framework.

3.4

IT project dataset

classified group of *data records* (3.3), into which collected data records are selected by pre-defined criteria

Note 1 to entry: Classification criteria for an IT project dataset might be based on the information needs of the owner and/or users of data.

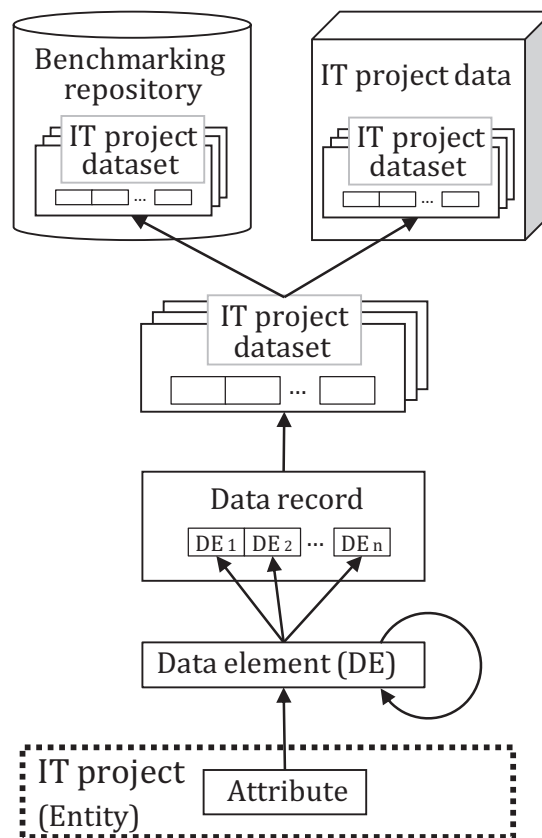
4 Abbreviated terms

IT information technology

5 Requirements and guidance for data definition

5.1 IT project data structure overview

In the framework of IT project performance benchmarking in the ISO/IEC 29155 series, there are two major data stores, which are “benchmarking repository” and “IT project data” (see [Figure C.1](#)). [Figure 2](#) illustrates the overall data structure of these data stores.



NOTE To simplify this figure, only one instance of each construct is shown. In the actual implementation of the benchmarking framework, several instances of each construct might be defined.

Figure 2 — Data structure in the IT project performance benchmarking framework

An IT project is the entity of interest within a benchmarking framework that has various attributes to represent its property or characteristics.

An attribute is measured (or recorded) and stored into a data element. A data element is the smallest unit of accessing and manipulating data in the framework of the ISO/IEC 29155 series (see 5.3 for details). The owner of a “benchmarking repository” and/or “IT project data” defines data elements for measuring and maintaining data. Benchmarking analysts may also define data elements for their benchmarking purpose.

A data element is defined by prescribing its properties (see 5.6 for details).

NOTE 1 Examples of properties of a data element are: Identifier, name, data type, and measurement unit.

NOTE 2 In the case of data elements in the “IT project data”, the purpose of data element definitions is not limited to the benchmarking activities. Data elements might also be defined to facilitate utilization of data in project management, quality assurance, financial management, and so on.

After defining data elements, one or more data records will be defined. A data record is a defined group of data elements, in which all the necessary data elements are included to represent attributes of interest of an IT project. One data record contains data of a specific IT project. Within the benchmarking framework, a data record is the typical object for maintaining and exchanging data of an IT project.

Data collection can be started after defining data elements and data record(s). In usual case, IT project is measured (or recorded) by IT project team, and data record(s) are submitted to the specific reception

desk or stored into a specified data storage. Collected data records may be collected and organized into several IT project datasets, which may be maintained independently.

NOTE 3 Classification criteria depend on the needs of the owner and/or users of data (see [5.5](#) for details).

Data in a benchmarking repository and/or an “IT project data” are retrieved by a benchmarking analyst for conducting an instance of benchmarking, or for issuing benchmark(s).

5.2 Attribute

An attribute is a property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means.

IT project is the major entity of interest in the ISO/IEC 29155 series.

NOTE In the ISO/IEC 29155 series, IT project attributes include, but are not limited to

- input for an IT project (e.g. requirements, resources, deliverables),
- outcomes of an IT project (which includes intermediate and temporary products together with final deliverables),
- information about an IT project itself (e.g. structures, processes, status, progress), and
- stakeholders (e.g. role, responsibility, expertise).

Usually, the first step in planning a specific instance of benchmarking information model is to select a set of IT project attributes that are relevant to the benchmarking needs. Selected attributes may be measured or recorded and maintained in the form of data elements to support various information needs in the future.

5.3 Data element

Within the IT project performance benchmarking framework, a data element is

- a) the smallest unit of data of IT project,
- b) usually implemented to be a data cell in a benchmarking repository and/or an “IT project data”, and
- c) defined by a responsible person who plans data collection or benchmarking.

NOTE 1 The responsible persons include, but are not limited to, benchmarking repository owner, IT project owner, benchmarking analyst, and benchmarking user.

For supporting benchmarking activities, benchmarking repository and “IT project data” usually contain explanatory information about the IT project (e.g. name and brief description of IT project, contact details of IT project team or data submitter) and/or its attributes (e.g. name of applied measurement method).

NOTE 2 See [Annex A](#) for more details of the nature of data elements.

5.4 Data record

Since tens or hundreds of data elements might be required to be measured and maintained within an IT project to meet multiple information needs of stakeholders, data elements and their order are usually organized.

A data record is a defined group of related data elements, in which all the necessary data elements are included to represent attributes of interest. One data record corresponds to a specific IT project.

The data record is the unit of measuring, maintaining, and exchanging data of an IT project in the benchmarking activities.

NOTE 1 Multiple data records might be defined from a set of defined data elements in an organization to satisfy individually different information needs. In such a case, a data element might be included in multiple data records.

NOTE 2 A data record is often defined in the form of an ordered set of data elements. Typical examples of such data record are a data table on spreadsheet and a table in a database,

EXAMPLE An IT project organization defined six data elements (project name, software size, total effort, total duration, number of test cases, and number of detected defects) to mandate IT project teams to measure and report. The quality assurance division of the organization defined a data record DR1 which consists of: project name, software size, number of test cases and number of detected defects. The project management office also defined a data record DR2 which consists of: project name, software size, total effort, and total duration. An IT project team measures six data elements and submits data in the form of required data records (DR1 for quality assurance division and DR2 for project management office).

5.5 IT project dataset

Data records in a data store (a benchmarking repository or an “IT project data”; see [Figure C.1](#)) may be bundled into group(s) to ease their usage and maintenance. Such groups are called IT project dataset within the IT project performance benchmarking framework.

An IT project dataset is a classified group of data records. The included data records might be selected by pre-defined criteria.

NOTE 1 Classification criteria for data record might be based on the information needs of the owner and/or users of data. Examples of dataset classification criteria are:

- data record definitions;
- project types(e.g. development, enhancement, and maintenance);
- business and/or application domain;
- organizational units;
- time period.

NOTE 2 A data record might be classified and stored into multiple IT project datasets.

NOTE 3 In implementing a physical data storage, multiple IT project datasets might be stored into a physical single data storage.

IT project datasets are stored and maintained in

- a benchmarking repository by the repository owner (e.g. benchmark provider or benchmarking service provider), and/or
- an “IT project data” by stakeholders of the IT project (e.g. IT project team, IT project owner, and benchmarking users).

5.6 Requirements for defining data elements

5.6.1 Overview of definitive properties

A data element is defined by prescribing a set of properties. A set of mandatory, recommended, and optional properties is summarized in [Table 1](#). Additional properties may be prescribed to enhance definition of a data element.

Detail of properties in [Table 1](#) are prescribed in [5.6.2](#) to [5.6.16](#).

Table 1 — Set of properties to define a data element

Property	Priority	Definition
<General properties>		
Identifier	[R]	Specify code or serial number of the data element.
Short name	[R]	Specify short name of the data element.
Name	[M]	Specify name of the data element.
Description	[M]	Specify overview information of the data element by describing meaning, purpose, and so on.
Priority	[O]	Specify priority of the data element (e.g. mandatory, recommended, optional).
Confidentiality	[O]	Specify condition of disclosure.
<Categorization properties>		
Reproducibility	[M]	Specify whether the value is reproducible or not.
Scalability	[M]	Specify whether the value is scalable or not.
<Measurement-related properties>		
Data type	[M]	Specify data type (e.g. integer, real number, string, enumeration) and its sub-properties.
Measurement unit	[Ms]	Specify measurement unit. [Applicable only for scalable data elements]
Precision	[Rs]	Specify required precision of value. [Applicable only for numeric data type]
Timing	[R]	Specify when the data element is produced.
Procedure	[M]	Specify how to produce the value of the data element, by describing logical sequence of operations (together with algorithms, if applicable), or by specifying a list of applicable existing procedures.
Source data elements	[Rr]	Specify the list of data elements which are necessary to produce value.
Dependency	[M]	Specify the list of data elements which are necessary to interpret value (e.g. qualifiers. See Annex A).
NOTE 1 Priority (upper case character): [M] Mandatory, [R]: Recommended, [O]: Optional.		
NOTE 2 Priority (lower case character): [s]: Scalable data element, [r]: Reproducible data element, <none>: Applies to both.		

5.6.2 Identifier

Data element should have a property called identifier. An identifier may be a code or a serial number.

If an identifier is specified, it shall be unique within IT project dataset.

NOTE Identifier is often referred for designing physical database or spreadsheet.

5.6.3 Short name

Data element should have a property called short name. If a short name is specified, it shall be unique within IT project dataset.

NOTE Users usually prefer short name rather than any technically generated identifier or long name, since it is easier to remember or refer.

5.6.4 Name

Data element shall have a property called name. A data element name shall be unique within an IT project dataset.

5.6.5 Description

Data element shall have a property called description.

Description should include, but is not limited to

- meaning of the data element,
- purpose of measurement (or recording), and
- relationship(s) to other data element(s), if applicable.

NOTE Description does not need to be exhaustive if the meaning, purpose or relationships are obvious from its name or other properties.

5.6.6 Priority

Data element may have a property called priority.

NOTE An example of priority rating is: "{mandatory, recommended, optional}".

5.6.7 Confidentiality

Data element may have a property called confidentiality. This property specifies the condition of disclosure.

Examples of confidentiality specification are

- the value of this data element shall be disclosed only to the benchmarking repository owner,
- the value of this data element shall be disclosed only to the quality assurance division staff, and
- the value of this data element shall be disclosed to only to the pre-authorized person.

5.6.8 Reproducibility

Data element shall have a property called reproducibility. This property designates whether the value of the data element is reproducible or not.

NOTE The value of a data element is reproducible if and only if it's source data elements are included in the data record.

5.6.9 Scalability

Data element shall have a property called scalability. This property designates whether the value of the data element has measurement scale or not.

NOTE Examples of descriptive data elements are: name of IT project, telephone number, textual explanation, photograph, and movies.

5.6.10 Data type

Data element shall have a property called data type. [Table 2](#) shows examples of data types.