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

Part 1:
Concepts and definitions

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

Partie 1: Concepts et définitions

Contents

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.

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

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

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ISO/IEC 29155-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

ISO/IEC 29155 consists of the following parts, under the general title *Systems and software engineering — Information technology project performance benchmarking framework*:

⎯ *Part 1: Concepts and definitions*

The following part is under preparation:

⎯ *Part 2: Requirements for benchmarking*

Introduction

This part of ISO/IEC 29155 identifies a framework which consists of activities and components that are necessary to successfully identify, define, select, apply, and improve benchmarking for information technology (IT) project performance. It also provides definitions for IT project performance benchmarking terms.

This part of ISO/IEC 29155 is intended to provide a framework about issues and considerations for data selection and comparison in information technology (IT) project performance benchmarking.

The starting point for this part of ISO/IEC 29155 and the ISO/IEC 29155 series was the concept outlined by the draft ISBSG (International Software Benchmarking Standards Group) benchmarking standard. IT project performance benchmarking is a combination of several different advanced technologies and practices in the area of quantitative analysis and management. Thus the framework introduced in this part of ISO/IEC 29155 can be built on the basis of various standardized key technologies such as:

— project management (e.g. PMBOK Guide and ISO 10006),

— systems and software measurements (e.g. ISO/IEC 15939),

— software life cycle processes (e.g. ISO/IEC 12207),

— systems life cycle processes (e.g. ISO/IEC 15288),

— functional size measurement (e.g. ISO/IEC 14143 series and related methods),

— systems and software quality evaluations (e.g. ISO/IEC 25000 family and ISO/IEC 9126 series).

This part of ISO/IEC 29155 is designed to conform to the concepts within ISO/IEC 12207 (software life cycle processes), ISO/IEC 15288 (systems life cycle processes), the ISO/IEC 14143 series (functional size measurement), the ISO/IEC 15504 series (process assessment), ISO/IEC TR 12182 (categorization of software), or ISO/IEC 14764 (maintenance of software life cycle processes).

IT project performance benchmarking instances are initiated and conducted for various reasons. Among the most common reasons are:

a)   need to improve project management maturity,

b)   need to improve project estimation capability,

c)   need to compare productivity between different project types and technologies,

d)   need to compare project productivity between similar industries,

e)   need to find the most effective targets for IT development process improvement.

Much has been written regarding the trials of establishing an IT project benchmarking framework, and statistics bear witness to the high failure rate of measurement programs. The most probable causes for failure have been disappointment in the benchmarking outcome 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.

This part of ISO/IEC 29155 is developed as the first of multiple parts which will complete the IT project performance benchmarking framework as is shown in Figure 1. This part of ISO/IEC 29155 is the concept standard; it contains no mandatory requirements. The requirements for the benchmarking process will be

specified subsequent to the standardization of the concepts and definitions. Then, the guidelines for the quality and quantity of different inputs and benchmarking outputs will be drafted, together with the domain-specific control needs.
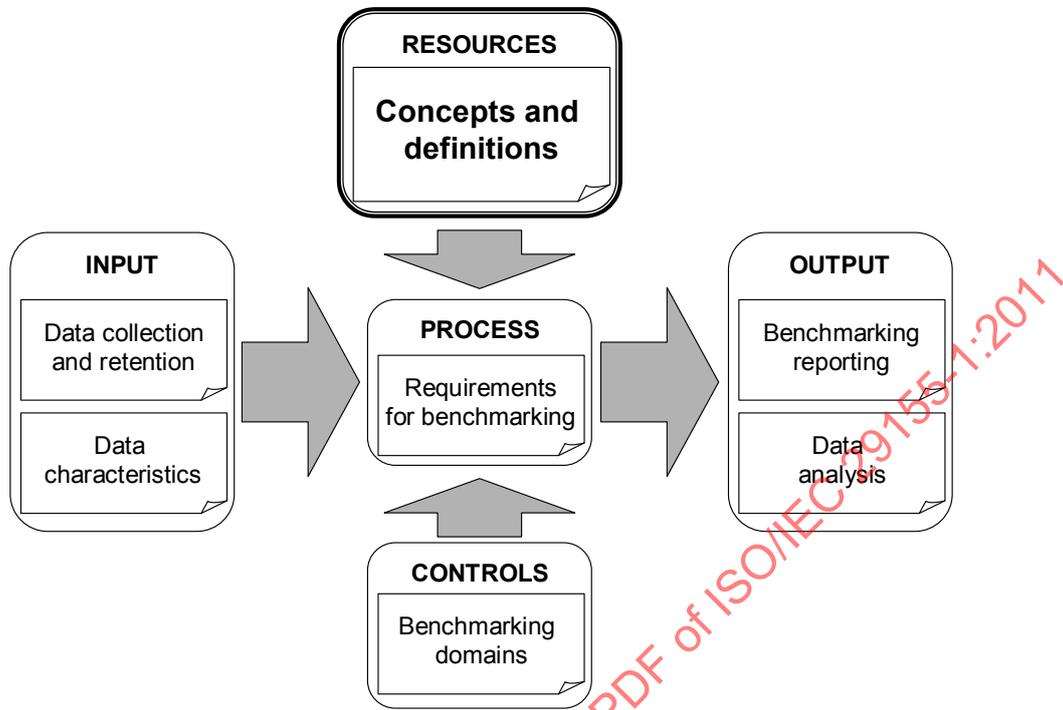

Figure 1 — IT project performance benchmarking framework overview

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

Part 1:
Concepts and definitions

1   Scope

This part of ISO/IEC 29155 identifies a framework for information technology (IT) project performance benchmarking (e.g. development or maintenance productivity) and related aspects (e.g. data collection and software classification).

The framework consists of activities and components that are necessary to successfully identify, define, select, apply, and improve benchmarking for IT project performance. It also provides definitions for IT project performance benchmarking terms.

The target audience of this part of ISO/IEC 29155 are stakeholders of IT project performance benchmarking.

NOTE   The following are examples of how this part of ISO/IEC 29155 can be used:

⎯   by a Benchmarking service provider who wants to align their benchmarking process to be consistent with this part of ISO/IEC 29155;

⎯   by a Benchmarking user (or third-party agents) for evaluating the performance of an IT project;

⎯   by an organization internally to answer specific information needs.

This part of ISO/IEC 29155 does not prescribe how to organize benchmarking. It is out of the scope of this part of ISO/IEC 29155 to prescribe the name, format, or explicit content of the documentation to be produced from the benchmarking process.

2   Terms and definitions

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

2.1
benchmark
reference point against which comparisons can be made

NOTE   In the context of the ISO/IEC 29155 series, IT project performance(s) is the object of comparison.

2.2
benchmarking
activity of comparing objects of interest to each other or against a benchmark to evaluate characteristic(s)

NOTE   In the context of the ISO/IEC 29155 series, the object of interest is IT project performance, and the characteristic is a particular aspect of an IT project such as productivity.

2.3
Benchmarking experience base
information store that contains the evaluation of the information products and the benchmarking activity as well as any lessons learned during benchmarking and analysis

NOTE   ISO/IEC 15939:2007 defines "information product" as "one or more indicators and their associated interpretations that address an information need". For example, information product could include templates, graphs, statistical algorithms, and interpretation guidelines.

2.4
benchmarking method
logical sequence of general steps to describe the process of comparing one or more attributes against a reference attribute with respect to a specified scale

2.5
Benchmarking user
person or organization that utilizes the outcome of benchmarking

2.6
instance of benchmarking
set of operations, described specifically, used in the execution of a particular benchmarking according to a given method

2.7
IT project
information technology project
temporary endeavor undertaken to create or change a unique information technology product, system, or service

NOTE   The PMBOK Guide, Fourth Edition defines "project" as "a temporary endeavor undertaken to create a unique product, service or result". "IT project" is a specified subset of projects.

2.8
project performance
derived measure that gives an indication of some attribute associated with how well, how quickly, how effectively or how efficiently a project is carried out

2.9
repository
organized and persistent data storage that allows data retrieval

NOTE   Benchmarking repository is a repository which is designated for use as the source of comparative measures for the purpose of benchmarking.

2.10
repository administrator
person or organization that maintains and administrates data in a repository

3   Abbreviated terms

IT   Information Technology

4   Overview of the framework

4.1   General

This clause presents an overview of the IT project performance benchmarking framework. The objective is to orient the users of this part of ISO/IEC 29155 so that they can apply benchmarking properly within context.

4.2   Concepts of IT project performance benchmarking

4.2.1   Overall framework

This clause outlines the overall framework of IT project performance benchmarking.

As shown in Figure 2, the framework consists of the following categories of components:

— **Core benchmarking activities** category, which illustrates an instance of benchmarking;

— **Supporting activities** category, which provides Benchmarking information base and instruments for use in an instance of benchmarking;

— **Benchmarking information base** category, which contains data for use in an instance of benchmarking;

— **Benchmarking instruments** category, which assists stakeholders to conduct an instance of benchmarking;

— **External reference base** category, which provides alternative or additional external data (i.e. repository and/or benchmarks) for an instance of benchmarking;

— **Benchmarking experience base** category, which contains knowledge and lessons learned during benchmarking.
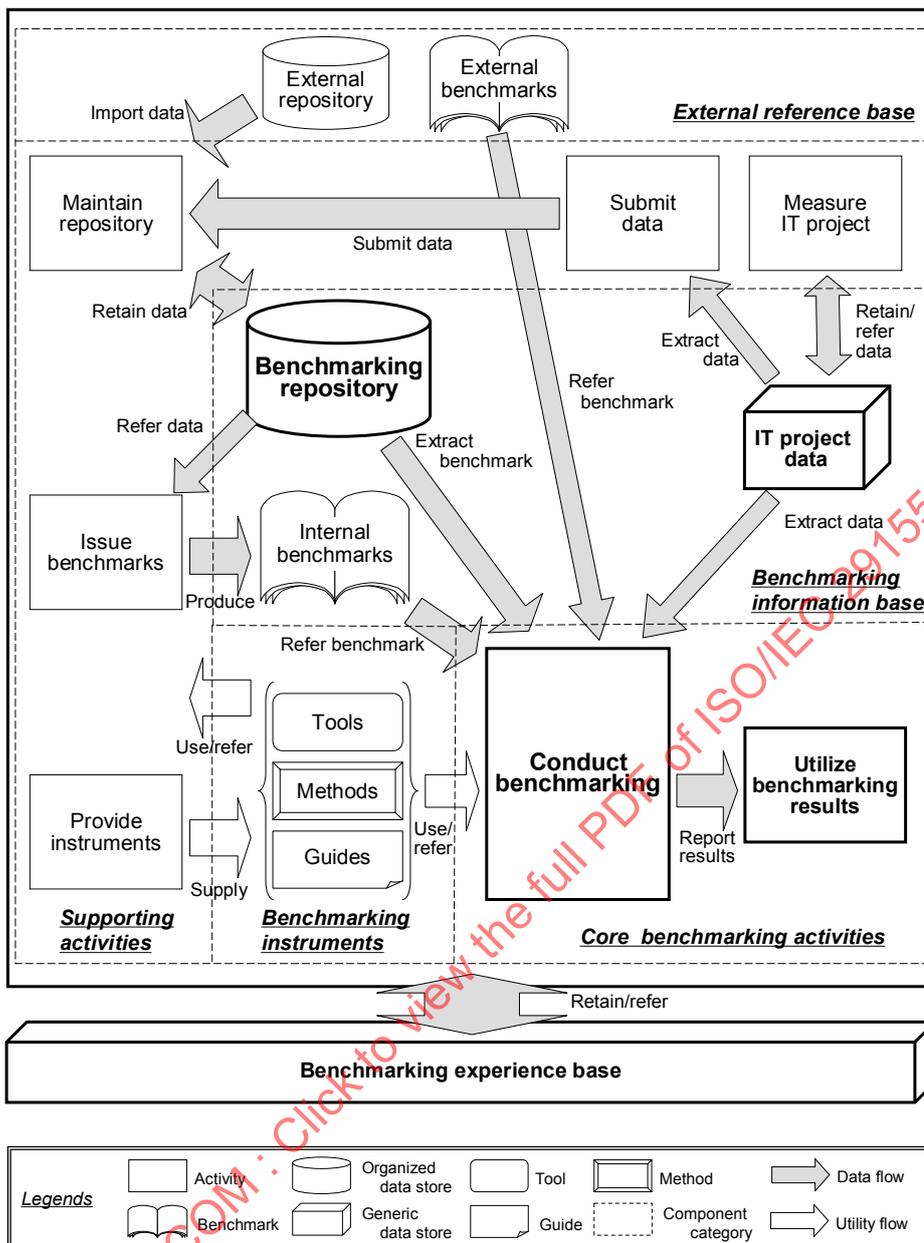
Figure 2 — IT project performance benchmarking framework

4.2.2 Core benchmarking activities

The Core benchmarking activities mainly address information needs of the Benchmarking users. Each activity has one or more processes to initiate, plan, execute, review and improve the activity. The activities can be grouped as follows:

a) **Conduct benchmarking.** This activity initiates and executes an instance of benchmarking.

b) **Utilize benchmarking results.** This activity indicates use of benchmarking results for various business purposes.

There are two approaches for conducting benchmarking:

— Extract benchmark from Benchmarking repository and compare it to specific IT project data.

— Refer a benchmark (i.e. Internal benchmarks or External benchmarks) and compare it to specific IT project data.

Examples of the usage are estimating, comparing, evaluating and managing performances of a specific IT project.

4.2.3 Supporting activities

The supporting activities provide the framework to assist Benchmarking users. Each activity has one or more processes to initiate, plan, execute, review and improve the activity. The activities can be grouped as follows:

a) **Measure IT project.** This activity measures IT project and retains data.

b) **Submit data.** This activity selects and provides IT project data to be included into a Benchmarking repository.

c) **Maintain repository.** This activity accepts, verifies, and then stores IT project data into a Benchmarking repository and manage the repository.

d) **Issue benchmarks.** This activity analyzes IT project data within a Benchmarking repository and provides Internal benchmarks.

e) **Provide instruments.** This activity develops and provides tools, methods, and guides to support every activity within the benchmarking framework.

In this framework, the activity of measuring IT project might be planned and conducted as an existing routine task of a project, or be done as an ad hoc task in support of an instance of benchmarking.

The activity of submitting data usually includes tasks to select and to review data before submission.

The management of a Benchmarking repository usually includes a lot of different tasks for different purposes, e.g. to assure data quality, to control data security, to ensure data anonymity (i.e. protect privacy of data submitter), to backup data, and so on.

The activity of issuing Internal benchmarks provides predetermined benchmarks which are authorized and shared by Benchmarking users.

4.2.4 Benchmarking information base

Three types of components exist in this category:

a) Benchmarking repository, which retains reliable project data to be referred as a benchmark;

b) IT project data, which retain various IT project data;

c) Internal benchmarks, which provide a group of commonly usable and authorized predetermined benchmarks.

The Benchmarking repository is the organized and persistent data store to retain verified project data. Project data in the Benchmarking repository are extracted in order to derive a benchmark in an instance of benchmarking.

The second component, IT project data, in the Figure 2 is the data store in which various project data are stored. This data store in this framework is a conceptual collection of all available information, and it might be

neither organized nor persistent. Data are not always stored in electronic storage in systematic forms. IT project data in this framework may be:

— collected in a variety of formats for different business purposes such as project tracking, time recording for payment, its existence,

— stored in a variety of media including electronic or paper copy,

— independently maintained by individual project teams.

Some measured data might be temporarily stored for a specific purpose e.g. project management, quality management, and so on. Such project data might be deleted when the purpose has been achieved or data have become obsolete.

The third component of Benchmarking information base is Internal benchmark. An Internal benchmark can be:

— a pre-extracted dataset,

— a set of data extraction conditions, or

— documented results of an instance of benchmarking.

Such a predetermined benchmark is created by analyzing a specific Benchmarking repository and usually issued as white-papers, data-books, technical reports, study papers, research papers, academic articles, and so on.

A predetermined benchmark can be an Internal benchmark, if and only if, it is authorized by the Benchmarking user.

Created Internal benchmarks can be:

— published in public (across organizations),

— distributed within an organization, or

— built-in into specific tools.

Internal benchmarks enable Benchmarking users to prepare reliable benchmarks without spending efforts to extract benchmarks from Benchmarking repository.

4.2.5 Benchmarking instruments

Three types of components exist in Benchmarking instruments category:

a) **Tools**, which provide means to support stakeholders;

b) **Methods**, which provide procedures;

c) **Guides**, which provide instructive information.

Tools can support various activities: e.g. to measure, collect, retain, extract and analyze data, as well as to report results. Those tools are not necessarily automated or computer-supported.

A method in this framework is a pre-defined procedure to conduct activities. Typical examples of method are statistical analysis methods which are applied and utilized to conduct an instance of benchmarking.

Guides give instructive information for stakeholders to establish and operate within benchmarking framework. Guides can be directives, implemented as e.g. textbooks, handbooks, comment boxes, tooltips, and so on. ISO/IEC 29155 series are also guides.

4.2.6 External reference base

Two types of components exist in the External reference base category:

a) **External repository**, which is repository data of external organization;

b) **External benchmarks**, which are issued in external organizations by analyzing External repositories.

An External repository is the dataset which is retained as a repository in external organization. This repository is included in this benchmarking framework to model activity to import a dataset from external organization.

NOTE   An External benchmark can also be adopted to be an Internal benchmark by the authorization of Benchmarking user.

4.2.7 Benchmarking experience base

The Benchmarking experience base is an archive of benchmarking outcomes and lessons learned.

NOTE   Information in the Benchmarking experience base will facilitate effectiveness of future benchmarking process. Those experiences will also be incorporated into Benchmarking instruments.

4.3   Stakeholders

Various stakeholders might be involved in IT project performance benchmarking. In this clause, activities of benchmarking in the framework of this part of ISO/IEC 29155 (see Figure 2), are broken down into roles and tasks.

From the viewpoints of roles, stakeholders can logically be classified into the following groups:

— **Benchmark provider,** who collects data and maintains Benchmarking repository, and provides benchmarks;

— **Benchmarking service provider**, who develops and provides instruments of benchmarking, and conducts benchmarking at the request of Benchmarking users;

— **Benchmarking user**, who utilizes outcomes of benchmarking;

— **Project team**, who measures projects, and in some cases submits data to Benchmark provider.

NOTE 1   Any person or organization can fulfill one or more of the above roles. For example, Benchmarking user can also be the Benchmarking service provider.

NOTE 2   In the context of this part of ISO/IEC 29155, tasks of project team include measurement related ones.

Figure 3 illustrates a basic role-sharing scheme among the four stakeholder groups onto the framework of this part of ISO/IEC 29155. There might be various role-sharing schemes in practice.

NOTE 3   For example, many Benchmark providers also provide benchmarking services, many academic researchers do not maintain repository by themselves but publish various benchmarks, and the Project team might be a potential Benchmarking user.

For each activity (shown as a box in Figure 3), five types of actors, either individuals or organizations, are assigned:

— **Activity sponsor**, who authorizes and supports the establishment of the activity;

— **Activity owner**, who is responsible for the activity;

— **Activity planner (designer)**, who is responsible for planning the activity;

— **Activity developer**, who is responsible for implementing the activity;

— **Activity operator**, who is responsible for executing the activity.
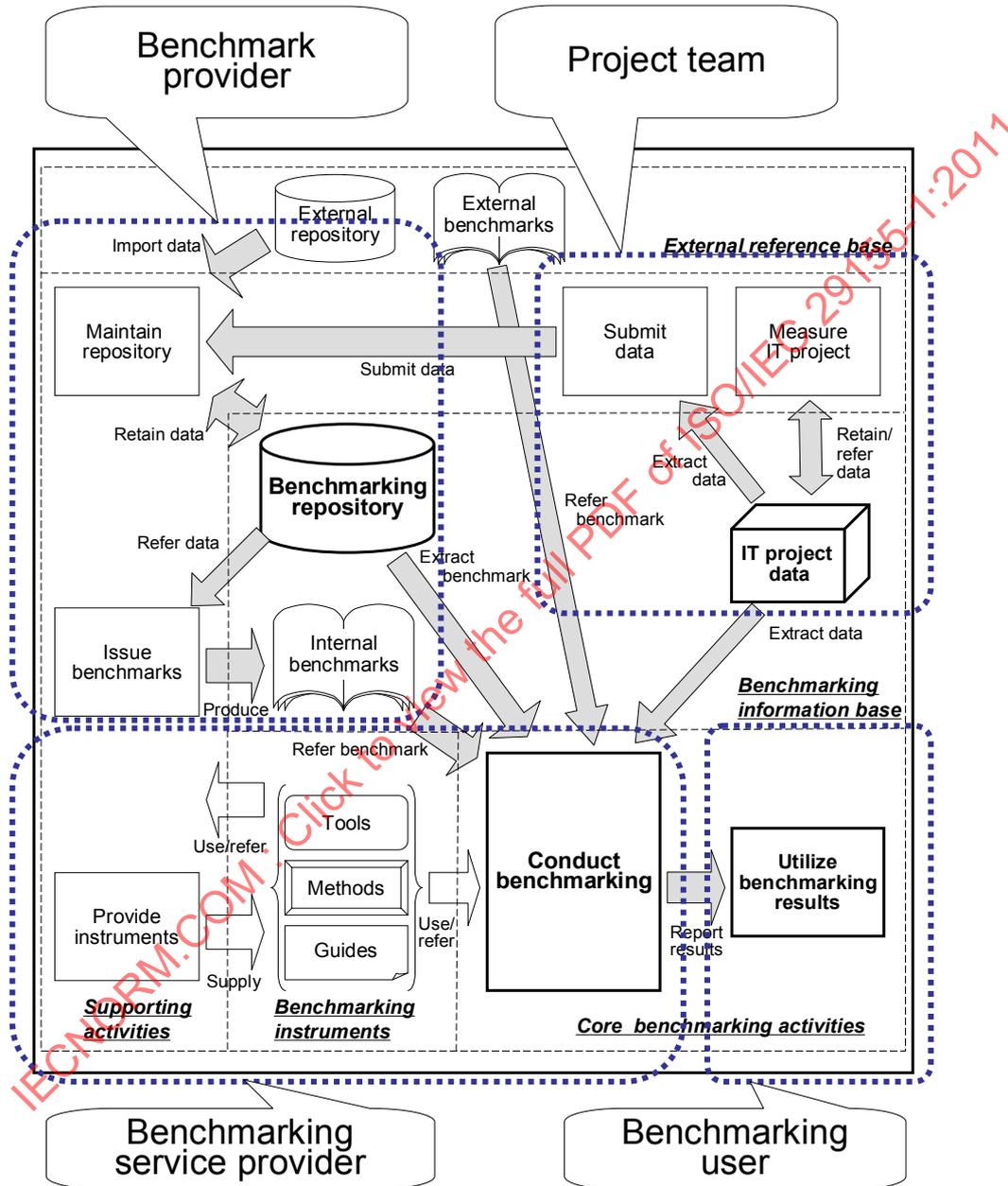
Figure 3 — An example of stakeholders and their roles

4.4   Types of benchmarking methods

The type of benchmarking method means the nature of the operations used to quantify an attribute. Two types are distinguished:

— Qualitative – quantification involving human judgement or comparison. An example would be rating some aspect in line with a model. While often expressed numerically these will be ordinal measures arrived at by subjective judgement.

— Quantitative – based on numerical rules. It might be subjected to arithmetic processes.

4.5   IT project categories

All IT projects are not similar to each other by nature, and they might not be directly comparable for all benchmarking purposes. For these reasons it is important to specify the project category. An IT project (for software, system, service) can be performed as:

— customer specific new development,

— new product development,

— version enhancement,

— package configuration,

— data conversion,

— integration development.

Maintenance and support of systems and software are continuous activities in general. In the context of ISO/IEC 29155 series, benchmarking of maintenance and support is specified in terms of some (agreed) maintenance and support time period.

NOTE   Categories of IT projects are defined in [17]. Category and process of maintenance are defined in ISO/IEC 14764.

5   Additional standardization areas of benchmarking framework

5.1   General

The concepts of IT project performance benchmarking are related to the areas as follows:

— requirements for benchmarking;

— benchmarking domains;

— data collection and retention;

— data characteristics;

— data analysis;

— benchmarking reporting.

These are described in clauses 5.2 to 5.7.

5.2   Requirements for benchmarking

Each activity in Figure 2 has individual process, which consists of initiating, planning, executing, reviewing and improving the activity. Since activities in Figure 2 are classified from the viewpoints of roles in overall benchmarking framework, those activities may be divided and/or integrated in different manners in practice.

Figure 4 shows an example process for "Conduct benchmarking" activity in Figure 2. The process consists of five major groups of tasks:

— **Initiating**, which launches benchmarking;

— **Planning**, which establishes benchmarking plan;

— **Executing**, which executes benchmarking;

— **Reviewing**, which evaluates process and outcomes of benchmarking;

— **Improving**, which implements the changes.

These groups form a compact and organized activity chain.

NOTE   Processes of whole activities of benchmarking framework will be defined in ISO/IEC 29155-2.

A Benchmarking repository contains source data for benchmarking. A Benchmarking experience base archives benchmarking outcomes and lessons learned.

The black arrows in Figure 4 show the order of tasks, and the gray arrows show the information and/or data flow between task groups and information and/or data storages (i.e. Benchmarking repository, Benchmarks, and Benchmarking experience base).
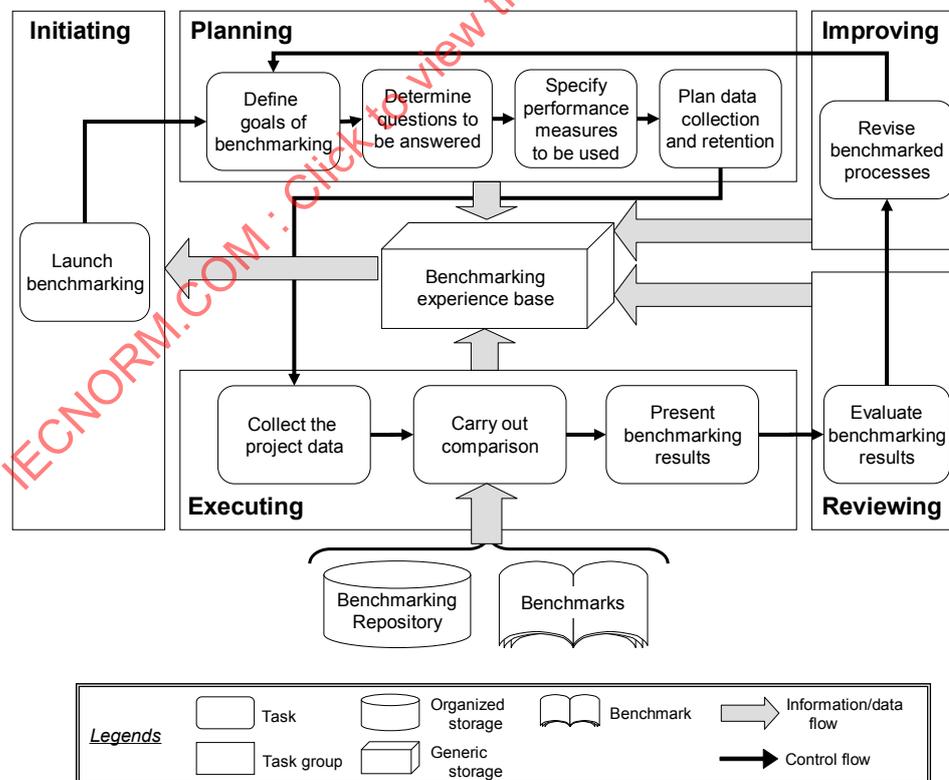

Figure 4 — An example process for Conduct benchmarking activities