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Information technology — Software measurement — Functional size measurement —

Part 6: Guide for use of ISO/IEC 14143 series and related International Standards

Technologies de l'information — Mesurage du logiciel — Mesurage de la taille fonctionnelle —

Partie 6: Guide pour l'usage de la série ISO/CEI 14143 et des Normes internationales connexes

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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.

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 14143-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering.*

ISO/IEC 14143 consists of the following parts, under the general title *Information technology — Software measurement — Functional size measurement*:

— *Part 1: Definition of concepts*

— *Part 2: Conformity evaluation of software size measurement methods to ISO/IEC 14143-1:1998*

— *Part 3: Verification of functional size measurement methods* [Technical Report]

— *Part 4: Reference model* [Technical Report]

— *Part 5: Determination of functional domains for use with functional size measurement* [Technical Report]

— *Part 6: Guide for use of ISO/IEC 14143 series and related International Standards*

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Introduction

Functional Size Measurement (FSM) is a technique used to measure the size of software by quantifying the Functional User Requirements of the software. The first published method to embrace this concept was Function Point Analysis, developed by Allan J. Albrecht in the late 1970s. Since then, numerous extensions and variations of the original method have been developed. In the field of ISO/IEC International Standards, the following Functional Size Measurement-related International Standards and Technical Reports have been published:

— ISO/IEC 14143 series, parts 1 to 5,

— ISO/IEC 19761:2002,

— ISO/IEC 20926:2002,

— ISO/IEC 20968:2002, and

— ISO/IEC 24570:2004.

This part of ISO/IEC 14143 was established to provide FSM Method users and developers with a guide as to how these International Standards and Technical Reports relate to each other and how to use them.

The Functional Size (FS) obtained by measuring a piece of software contributes to a better understanding of the characteristics of the software, as well as the development, maintenance and support activities thereof. The three types of International Standards and Technical Reports related to the definition and use of FS and/or Functional Size Measurement (FSM) are:

a) Concept Standards: Describe concepts and provide definitions;

b) Supporting Standards: Supply information to assist in the evaluation of Functional Size Measurement Methods (FSMM) and examples of the software domains that they measure; and

c) Method Standards: Define instances of FSMMs.

Any FSMM, other than the Method Standards, can be used to measure FS as long as it conforms to ISO/IEC 14143-1. FSMMs can vary in their capability to measure software in different domains. Therefore, before deciding on which FSMM to use, it is advisable to assess the capability of the method to adequately size the software to be measured.

This part of ISO/IEC 14143 provides guidance on how to select a suitable FSMM using all FSM-related International Standards.

The FS results obtained from applying the selected FSMM can be used for a variety of purposes throughout the life cycle of the software. This part of ISO/IEC 14143 also provides illustrative examples of how to use FSM and functional size to manage aspects of software development and maintenance.

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Information technology — Software measurement — Functional size measurement —

Part 6: Guide for use of ISO/IEC 14143 series and related International Standards

1 Scope

This part of ISO/IEC 14143 provides a summary of the FSM-related standards and the relationship between:

— the ISO/IEC 14143 series FSM framework International Standards that provide the definitions and concepts of FSM and conformance and verification of FSMMs, and

— the ISO/IEC standard FSMMs, i.e. ISO/IEC 19761, ISO/IEC 20926, ISO/IEC 20968 and ISO/IEC 24570.

This part of ISO/IEC 14143 also provides a process to assist users to select and develop an FSMM that meets their requirements as well as provides guidance on how to use FS. This part of ISO/IEC 14143 also gives guidance on how to use FS. FSMMs include, but are not limited to, ISO/IEC 19761, ISO/IEC 20926, ISO/IEC 20968 and ISO/IEC 24570.

NOTE An FSMM is a software sizing method that conforms to the mandatory requirements of ISO/IEC 14143-1. Recommending a specific FSMM is outside the scope of this part of ISO/IEC 14143.

The audiences of this part of ISO/IEC 14143 are:

— users and potential users of FSM; and

— developers of an FSMM.

2 Abbreviated terms

BFC Base Functional Component

FS Functional Size

FSM Functional Size Measurement

FSMM Functional Size Measurement Method

FUR Functional User Requirement

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3 FSM related standards (ISO/IEC 14143 series), FSMM standards, and their interrelationships

3.1 Outlines of FSM related standards

3.1.1 Overview

Function Point Analysis was established in the late 1970's. It has subsequently been used worldwide. Over time alternative methods have been derived and devised. Although these methods vary in the rules they use to measure software, they all focus on measuring FURs of software.

ISO/IEC 14143-1 defines concepts of FSM and FSMM. Subsequent parts of ISO/IEC 14143 (ISO/IEC 14143 series) have been developed to evaluate FSMMs.

The following clauses outline these FSM related standards.

NOTE For copies of the Scope clauses of the FSM related standards, refer to Annex A of this part of ISO/IEC 14143.

3.1.2 ISO/IEC 14143-1

ISO/IEC 14143-1 is a Concept Standard and is a basis for other International Standards and Technical Reports that are categorized as Supporting Standards and Method Standards.

This part of ISO/IEC 14143 is the foundation standard of the series and has the following contents:

a) Definitions

b) Characteristics of FSMMs

c) Requirements for FSMMs

d) Process for applying an FSMM

e) FSMM labelling conventions

ISO/IEC 14143-1 is an International Standard.

3.1.3 ISO/IEC 14143-2

ISO/IEC 14143-2 is a Supporting Standard.

This part of ISO/IEC 14143 defines processes to check conformity of a Candidate FSMM with ISO/IEC 14143-1. Using ISO/IEC 14143-2 is recommended whilst the conformity assessment can be done without using ISO/IEC 14143-2.

ISO/IEC 14143-2 has the following contents:

a) Evaluator characteristics

b) Inputs to conformity evaluation

c) Tasks and steps of the conformity evaluation procedure

d) Conformity evaluation outputs

e) Conformity evaluation result

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In addition, there are the following annexes:

a) Evaluator capability (Informative)

b) Example of a conformity evaluation checklist (Informative)

c) Example of a conformity evaluation report (Informative)

ISO/IEC 14143-2 is an International Standard.

3.1.4 ISO/IEC TR 14143-3

ISO/IEC TR 14143-3 is a Supporting Standard.

For FSMM users wanting to evaluate the most suitable method for their needs or for developers who want to check their FSMM performance claims, this part of ISO/IEC 14143 provides a process to assess the performance properties of an FSMM. While there are many ways to do the verification, the use of ISO/IEC TR 14143-3 is recommended.

ISO/IEC TR 14143-3 has the following contents:

a) Verification team competency and responsibility

b) Verification inputs

c) Verification procedure

d) Verification outputs

In addition, it includes the following annexes;

a) Presentation of test requests (Normative)

b) Verification methods (Normative)

c) Example of a verification report (Informative)

ISO/IEC TR 14143-3 is a Type 2 Technical Report.

3.1.5 ISO/IEC TR 14143-4

ISO/IEC TR 14143-4 is a Supporting Standard.

This part of ISO/IEC 14143 provides a standard collection of Reference User Requirements, which are useful for comparing the FSM results among FSMMs. It also contains guidance on selecting Reference FSMMs. Together with ISO/IEC TR 14143-3, it enables the collection of normative, quantitative evidence of the performance of the FSMM.

ISO/IEC TR 14143-4 has the following requirements:

a) Reference User Requirements (RUR)

b) Reference FSMMs

In addition, it includes the following example Reference User Requirements in annexes;

a) Business application RUR (Normative)

b) Real time / Control RUR (Normative)

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c) RUR reference list (Informative)

ISO/IEC TR 14143-4 is a Type 2 Technical Report.

3.1.6 ISO/IEC TR 14143-5

ISO/IEC TR 14143-5 is a Supporting Standard.

This part of ISO/IEC 14143 was developed to describe the Functional Domains ("software types") to which a piece of software belongs or to which an FSMM can declare its applicability (as required by ISO/IEC 14143-1). This part of ISO/IEC 14143 provides a means to determine Functional Domains by describing the characteristics of Functional Domains and the procedures by which characteristics of FUR can be used to determine Functional Domains. Two example methods for implementing these principles are provided in the Informative Annexes.

ISO/IEC TR 14143-5 provides a process by which to define Functional Domains.

ISO/IEC TR 14143-5 has the following contents:

a) General requirements for Functional Domains

b) General requirements for characteristics of Functional Domains

c) Determining the Functional Domain for a given set of FUR

d) Determining the applicability of an FSMM to a particular Functional Domain

e) Example Functional Domain categorization methods

In addition, it includes the following annexes:

a) CHAR Method to determine Functional Domains (Informative)

b) BFC type method to determine Functional Domains (Informative)

ISO/IEC TR 14143-5 is a Type 2 Technical Report.

3.2 Outlines of standardized FSMMs

3.2.1 Method Standards

ISO/IEC provides four standardized FSMMs. They are:

— ISO/IEC 19761 (COSMIC-FFP method),

— ISO/IEC 20926 (IFPUG method),

— ISO/IEC 20968 (MkII method), and

— ISO/IEC 24570 (NESMA method).

NOTE FSMM is a generic acronym designating functional size measurement methods including "Function Point Analysis."

3.2.2 ISO/IEC 19761

ISO/IEC 19761 is the transposition of COSMIC Full Function Point (COSMIC-FFP) method. This FSMM assumes that software consists of functional processes that, in turn, consist of data movements, categorized

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into Entry, or data input type (E), Exit, or data output type (X), Read, or data read type (R) and Write, or data write type (W). In the COSMIC-FFP method, the measurement unit is an instance of a data movement, of any of the four types recognized by the COSMIC-FFP method.

This FSMM claims applicability to both Management Information System (MIS) type software and Real time type software.

NOTE The Common Software Measurement International Consortium (COSMIC) maintains the COSMIC-FFP method.

3.2.3 ISO/IEC 20926

ISO/IEC 20926 is the transposition of the IFPUG 4.1 Unadjusted functional size measurement method. This FSMM assumes that software consists of BFC types of External Input type (EI), External Output type (EO), External Inquiry type (EQ), Internal Logical File type (ILF), and External Interface File type (EIF).

These five elements are BFCs for the FSM.

This FSMM claims it is applicable to all types of software.

NOTE The International Function Point Users Group (IFPUG) maintains IFPUG method.

3.2.4 ISO/IEC 20968

ISO/IEC 20968 is the transposition of MkII Function Point Analysis (Mk II method). This FSMM assumes that software consists of logical transactions and measures the number of input data element types (Ni), entity types referenced (Ne) and output data element types (No).

This FSMM claims applicability to any software type where logical transactions can be identified.

NOTE The UK Software Metrics Association (UKSMA) maintains MkII method.

3.2.5 ISO/IEC 24750

ISO/IEC 24750 is the transposition of NESMA software sizing method. It is very similar to the IFPUG method except that it has the following extra methods of measuring software sizes;

a) The estimated function point count

b) The indicative function point count

The above two methods are provided for use in the early stages of software development.

This FSMM claims applicability to all software types.

NOTE The Netherlands Software Metrics Users Association (NESMA) maintains the NESMA method.

3.3 Relationship between FSM related standards

This clause describes the relationship among the FSM related standards.

ISO/IEC 14143-1 defines FSM and describes the characteristics of an FSMM and the requirements that a software sizing method must exhibit in order to be recognized by ISO/IEC as an FSMM. ISO/IEC 14143-1 is the foundation standard for FSM related ISO/IEC standards.

FSMM users need to evaluate the most suitable method for their needs by first ensuring that it conforms to ISO/IEC 14143-1 and then verifying the match of the method's capabilities to the their performance needs.

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A candidate FSMM can be claimed as an FSMM only when it has been assessed to conform to the mandatory requirements of ISO/IEC 14143-1. While there are many ways to do the assessment, it is recommended to use ISO/IEC TR 14143-3. ISO/IEC 19761, ISO/IEC 20926, ISO/IEC 20968 and ISO/IEC 24570 are four verified FSMM.

Once a candidate FSMM has been qualified as an FSMM using ISO/IEC 14143-2, then its performance is assessed using ISO/IEC 14143-2.

When assessing the performance of an FSMM, it is useful to apply the FSMM to standardized sets of FURs. ISO/IEC TR 14143-4 provides such standardized FURs. ISO/IEC TR 14143-4 also offers, by the same token, the means to obtain the reference measurement cases to compare FSMMs amongst themselves. It provides Reference User Requirements.

An important requirement of users or developers of FSMMs is an ability to identify applicability of the FSM to the Functional Domain of the software they are measuring. ISO/IEC TR 14143-5 describes how to define Functional Domains.

ISO/IEC 14143-6 provides the guide for using the FSM related standards as well as a process to assist users in selecting the most appropriate FSMM for their needs.

Figure 1 illustrates the relationship between FSM related International Standards stated in the text above.

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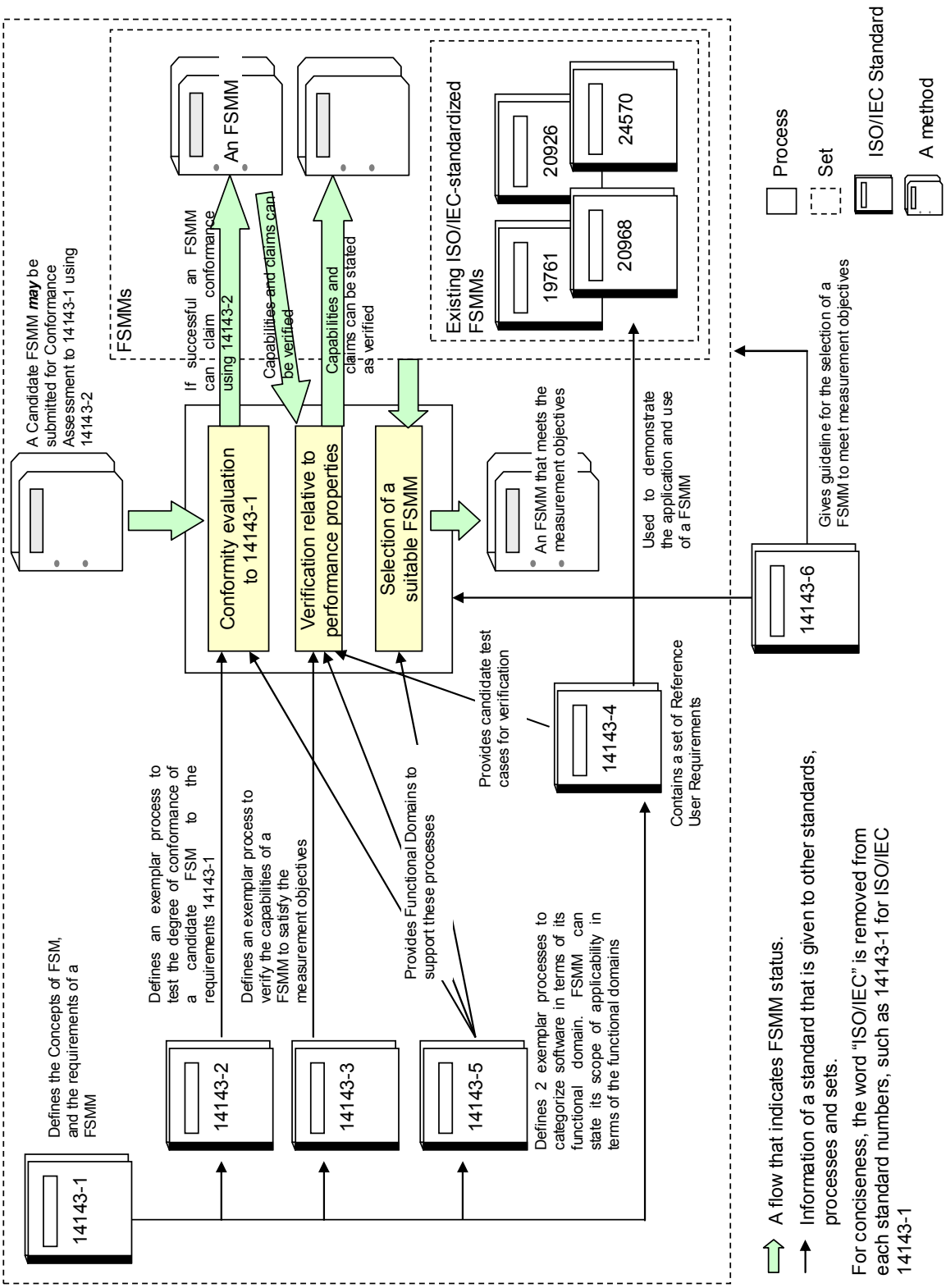

Figure 1 — Relationship between FSM related international standards

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3.4 Guidelines for usage of FSM related standards

This clause gives a brief explanation of each ISO/IEC FSM related standard from the point of view of FSM users and FSMM developers.

3.4.1 Guidelines for FSM users

When users choose and adopt one or more of FSMMs,

a) ISO/IEC 14143-1 is used to understand the definition and characteristics of FSMMs,

b) ISO/IEC 14143-2 is used to check the conformity of the FSMM to ISO/IEC 14143-1,

c) ISO/IEC TR 14143-3 is used to verify the statements (i.e. performance properties) of an FSMM and/or to conduct tests requested by the verification sponsor,

d) ISO/IEC TR 14143-4 provides standard sets of RURs to compare the measurement results among FSMMs,

e) ISO/IEC TR 14143-5 can be used to determine Functional Domains by evaluating characteristics of FUR, and

f) ISO/IEC 19761, ISO/IEC 20926, ISO/IEC 20968 and ISO/IEC 24570 are FSMMs that are available to be assessed, verified, compared and then selected.

3.4.2 Guidelines for FSMM developers

When FSMM developers are designing a Candidate FSMM,

a) ISO/IEC 14143-1 is used to understand the definition and characteristics of FSMMs,

b) ISO/IEC 14143-2 is used to check the conformance of the Candidate FSMM to ISO/IEC 14143-1,

c) ISO/IEC TR 14143-3 is used to verify the FSMM to its own claims (i.e. performance properties),

d) ISO/IEC TR 14143-4 is used to obtain the reference measurement results to evaluate the Candidate FSMM,

e) ISO/IEC TR 14143-5 is used to describe the Functional Domains to which the Candidate FSMM is applicable.

4 Use of FSM and FS

4.1 Overview

This clause describes some uses for FSM and FS. It is neither intended to be a manual for the use of FSM nor is it intended to be exhaustive.

The uses of FSM and FS are organized into two parts: uses for project management and uses for performance management.

NOTE 1 FSM is performed by an FSMM. In the following clauses, the use of FSM and FS is described, not the use of FSMM.

NOTE 2 The user needs for software may include non-functional requirements (refer to ISO/IEC 14143-1), in addition to the FUR. Some methods for sizing software consider these Quality and Technical Requirements through the use of one or more steps additional to those needed for FSM. These additional steps are not part of the process of applying an FSMM (refer to ISO/IEC 14143-1), but may contribute to the practical use of FS as described in the sections which follow.

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4.2 Project management

This description of the uses of FSM and FS addresses how FS could be applied to the management and control of software projects.

4.2.1 Project resource forecasting

For new development and enhancement projects, an algorithmic forecasting model can be constructed from various types of data collected from a sample of completed projects, for example, FS, Quality Requirements, Technical Requirements, the resources consumed (expressed as cost, effort, or schedule consumed), and the demographic characteristics expected to have had an influence on the amount of resources consumed. Once a model has been constructed, a forecast of resources can be generated early in the lifecycle of future software projects by entering, for example, the following information into the model:

a) the FS of the software;

b) the expected influence of Quality Requirements, Technical Requirements, and demographic characteristics; and

c) the expected delivery rate for this type of software development.

NOTE Software enhancement is the process of modifying software to add, change, and delete user functionality, whereas software maintenance is the process of modifying software to correct defects, improve performance, and support computing environment changes (such as the addition of new types of data storage devices).

4.2.2 Tracking the progress of a project

At an early point in a software project's lifecycle, FSM can create an inventory of BFCs for the development or enhancement of software. The project manager can use this inventory to track and communicate the progress of the project, firstly, by tracking changes to the target set of BFCs (that is, by identifying BFCs added and deleted from the inventory) and secondly, by noting BFCs which have and have not been developed. The project's progress can then be communicated as the percentage of target BFCs which have passed a milestone or have been completed.

4.2.3 Managing scope change

At an early point in a software project's lifecycle, FSM can determine the scope of the software by creating an inventory of BFCs agreed to by the users and the software supplier. For each change to this set of BFCs, FS could be calculated and entered into an estimating model to forecast the effort and schedule impact. The impact could be used to negotiate modifications to the software scope and project plan.

4.2.4 Package functionality fit

FSM can assist in expressing the fit of the functionality provided by a package to the functional requirements. An FS could be measured for the functional requirements. An FS could also be calculated for the functional requirements satisfied by the package. The degree of fit could be expressed, using another FS, as the proportion of the functional requirements satisfied.

4.2.5 Post-mortem analysis

All actual results and resource expenditure should be related to the FS to make them comparable with other projects.

4.3 Performance management

This clause addresses how FS could be applied to forecasting resource usage and the management of performance. This typically involves the use of FS as a normalizing factor and the collection of a large amount of data to create models.

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4.3.1 Productivity management

An FSM can assist with managing the productivity of software development, enhancement, and maintenance processes. Productivity indicators and demographic characteristics could be analyzed to determine which demographic characteristics have the greatest impact on productivity. Demographic characteristics are environmental, project, and/or staff characteristics which could influence the software development, enhancement, or maintenance processes. Examples are staff experience, tools usage, user relationships, working conditions, staff business knowledge, and development language. Productivity could be managed by manipulating those characteristics and monitoring the productivity trends of future software projects to see if the desired effect has been achieved.

4.3.2 Quality management

An FSM can assist with managing the number of defects. Defect density (the ratio of the number of defects identified within a period of time to FS) could be analyzed to determine which demographic characteristics have the greatest impact on defect density. Defect density could be managed by manipulating those characteristics and monitoring the defect density trends of future software projects to see if the desired effect has been achieved.

4.3.3 Organizational maturity and process capability

An FSM can provide a base of quantitative measurement necessary to support higher levels of organizational maturity or process capability.

4.3.4 Accounting for an organization's software asset

An FS could be measured for part or all of an organization's application portfolio and entered into an estimating model to determine the software asset value or the total cost of replacement, re-engineering. or outsourcing.

4.3.5 Budgeting for maintenance

An FSM can assist with budgeting for the maintenance of an organization's software portfolio. FS of the portfolio, as well as the maintenance cost or effort compared to FS, could be monitored. This information could be used to forecast maintenance budgets.

4.3.6 Contract management

An FSM can be used as part of managing the cost and schedule of software development by software suppliers.

5 FSMM selection and development processes

5.1 Outline of clause 5

This clause describes the use of ISO/IEC 14143 series to assist in the following processes:

a) a process to assist a user to select an FSMM to ensure that the FSMM satisfies the requirements of the user, and

b) a process to assist FSMM developers to create one that is conformant to ISO/IEC 14143-1, and that it is an effective FSMM for the domain for which it is applicable.

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5.2 Process to select a suitable FSMM

5.2.1 Overview of FSMM selection process

This clause describes a process to assist a user to select an FSMM that meets their needs, using ISO/IEC 15939:2002 [8]. ISO/IEC 15939 describes a process for measures selection. As FSMM selection is a process to choose a method that provides measure(s), the following items of clause A.1 of ISO/IEC 15939 are required for FSMM selection:

a) Characterization of organizational units,

b) Identification of information needs, and

c) Selection of measure.

For the purposes of this part of ISO/IEC 14143, a process that is customized from the above for FSMM selection is called “FSMM selection process”. The outline of the process is shown in Figure 2. Examples described in this section can be found in Annex F of ISO/IEC 15939: 2002.

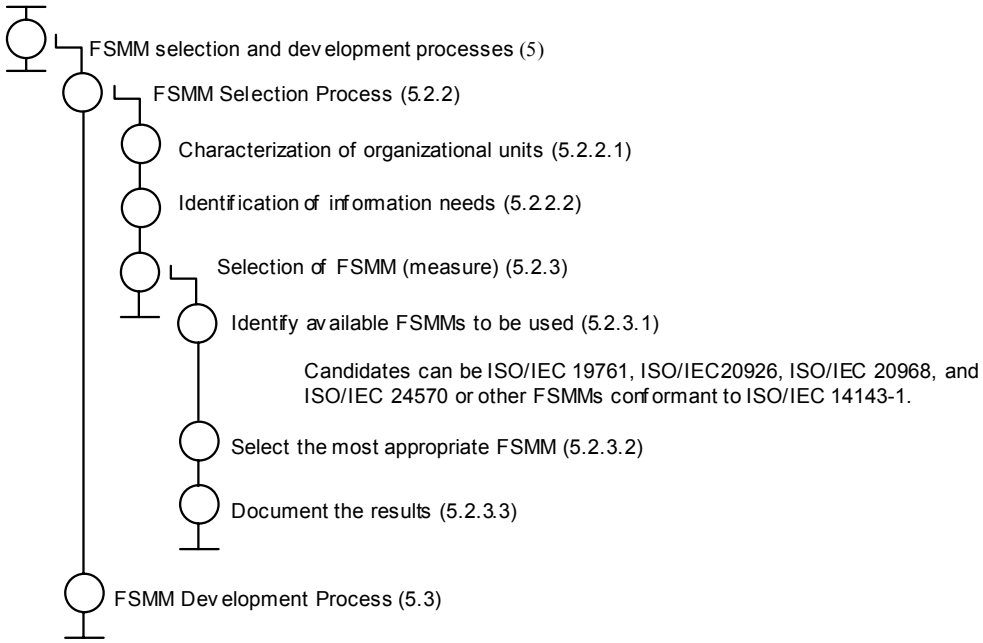

Figure 2 — Outline of FSMM selection

5.2.2 FSMM selection process

5.2.2.1 Characterization of organizational units

The requirements for an effective FSMM will be different, for different organizations, depending on the type of software to be measured and the accuracy required for the measurement result. The most suitable FSMM is also dependent on how the resultant FS will be used. For instance, financial organizations typically select FSMMs that accurately and repeatably measure Management Information type software (MIS). In contrast, chemical plants would require FSMMs that can be applied to Functional Domains that could be described as being ‘Real time’. Therefore, FSMM selection starts with the categorization of an organization’s software into Functional Domains. If an organization required FSM results for benchmarking productivity against industry figures then a commonly used FSMM would be more suitable than one that had no industry figures available. If an organization only required ‘ball-park’ figures, then this would reduce the accuracy required for an FSMM when assessing its capabilities using ISO/IEC TR 14143-3.

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The following analysis process facilitates the selection of an appropriate FSMM:

a) Identify the area(s) of the organization to be measured and categorize their software into Functional Domains using ISO/IEC TR 14143-5. Functional Domains could be categories such as MIS, Real time, Scientific, and Infrastructure.

b) Determine the type of software procurement process utilized by the organization, for example, inhouse development, purchased off the shelf packages or outsourced third party development. The procurement process assists in determining the scope of the software activities that the FSMM is required to measure and the purpose of the measurement.

c) Identify which of the processes defined in ISO/IEC 12207 [2] are used by the organization and are within the scope of activities covered by the FSM. Processes could include planning, ordering, design, implementation and asset management. Organization specific processes could be used, however, it is highly desirable to use processes that are defined in ISO/IEC 12207.

d) Establish the performance of the organization's measurement process using ISO/IEC 15939 as a guide. The measurement capability of an organization affects the level of accuracy and amount of information that needs to be collected. It also impacts the selection of the measurement personnel and the required skill levels in information technologies. Measurement results may differ depending on the level of expertise of the people doing the measurement, the time available for the measurement and their purpose for measurement.

5.2.2.2 Identification of information needs

This clause describes a process to define and establish the requirements for the most appropriate FSMM based on the analysis of organizational characteristics stated in 5.2.2.1. The information needs of the organization are prioritized and rated during the analysis.

NOTE An example of rating is "essential", "desirable", "preferable" and "unnecessary." "High", "Medium" and "Low" is another example.

a) Analyze the purpose for which the FS results will be used. For this analysis, it is useful to develop and prioritize a list of purposes of FS.

b) Identify performance requirements such as repeatability, accuracy, convertibility, sensibility or ability of discrimination and adaptability for each purpose. Examples of performance requirements and their verification process are described in ISO/IEC TR 14143-3.

c) Determine the BFCs of the software that is to be measured and identify the stage of the development process that will provide the deliverable describing the BFCs to be measured. Date and time can be expressed in absolute manner such as "how many months after this process begins" and as a relative reference such as "in xxx process of development processes." An organization should determine which one is used by looking at its attributes.

5.2.3 Selection of FSMM

5.2.3.1 Identify available FSMMs to be used

Select one or more FSMMs based on the analysis done in 5.2.2.2. The following should be taken into account;

a) Information about available FSMMs such as the level of availability and quality of documentation, case studies, training, certification, qualified measurement personnel and supporting software tools. The level of maintenance and support of the FSMM by its developers, its level of use in the industry and availability of industry measurement data will also influence a choice, as with the applicability to the Functional Domains of the organization's software,

b) Ability to recognize and measure the BFCs identified in the organization's software at the point in time the measurement is required

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c) Whether the selected methods satisfy the organization's information needs, and

d) Priority of information needs.

NOTE See References [14] and [15] for some tools available for prioritizing.

5.2.3.2 Select the most appropriate FSMM

Determine the most suitable FSMM using the following process:

a) Check that an FSMM is conformant to ISO/IEC 14143-1. If a written conformance declaration to ISO/IEC 14143-1, as defined by ISO/IEC 14143-2, is not given by developers or owners, then test for conformance using ISO/IEC 14143-2 or another appropriate method.

b) If there are additional performance requirements of the FSMM, such as readability, repeatability and accuracy, verify that an FSMM satisfies these requirements using ISO/IEC TR 14143-3 and/or ISO/IEC TR 14143-4, or refer to any published verification documents.

c) Based on the results of the above processes, select the most appropriate FSMM for the user's FSMM requirements.

5.2.3.3 Document the results

Document the FSMM selection processes used and criteria for the selection to facilitate future re-evaluation as the organization's information needs change.

5.2.4 Related activities of performing FSM

To perform effective and accurate measurement using an FSMM selected by the process of 5.2.2 and 5.2.3 of this part of ISO/IEC 14143, the following should be done:

a) Clarify the measurement process and ensure that the people involved follow the process. It is necessary to define the steps that are actually used in FSM. The steps should define the collection method for the data being measured, FSM related activities, the reporting of measurement results and as well as storing and managing the results.

b) Clarify the review method and ensure that the people involved follow the steps. It is important to define the method to review the result and the method of managing measurement processes. This contributes to unification of measurement procedures which in turn can supply accurate measurement results.

c) Authorize the selected FSMM as well as the above steps and reserve resources. It is critical, through management review, to give authorization to the chosen FSMM, the procedure stated above and to reserve necessary resources for the measurement process.

d) It is desirable to acquire supporting tools or technologies for measurement, allocate sufficient space for data storage and provide for the necessary training of the people involved.

5.3 FSMM development process

When a developer intends developing an FSMM that will be conformant to ISO/IEC 14143-1, the steps below should be followed:

a) read and fully understand ISO/IEC 14143-1 for FSM concepts,

b) define the Functional Domain(s) to which Candidate FSMM can be applied using Annexes A or B of ISO/IEC TR 14143-5,

c) create a Candidate FSMM,

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d) evaluate conformance of the Candidate FSMM as to whether or not it meets the requirements of ISO/IEC 14143-1 using an appropriate method,

e) verify the FSMM using ISO/IEC TR 14143-3 for repeatability and reproducibility, accuracy, convertibility, discrimination threshold, applicability to Functional Domain(s), and document the verification results referencing Annex C of ISO/IEC TR 14143-3,

f) if step d) or e) fails, go back to c),

g) check to ensure that materials related to the FSMM are conformant to ISO/IEC 14143-1 and to the FSMM.

h) in order to benchmark the verified FSMM use the same set of Reference User Requirements, and compare measurement results of the FSMM with those of other FSMMs. It is recommended to do this comparison using Reference User Requirements in Annexes A and B of ISO/IEC TR 14143-4.

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Annex A
(informative)

Scopes of FSM related standards

NOTE This annex consists of the copies of the Scope clauses of FSM related standards. They are the latest at the time of publication.

A.1 ISO/IEC 14143 series

A.1.1 ISO/IEC 14143-1

ISO/IEC 14143-1 defines the fundamental concepts of Functional Size Measurement (FSM) and describes the general principles for applying an FSM Method. ISO/IEC 14143-1 does NOT provide detailed rules on how to:

— measure Functional Size of software using a particular method;

— use the results obtained from a particular method;

— select a particular method.

ISO/IEC 14143-1 is applicable when determining if a method for sizing software is an FSM Method. It does not prevent the development of various methods, but rather provides a basis for assessing whether a particular method conforms to FSM.

ISO/IEC 14143-1 is intended for use by those persons associated with the acquisition, development, use, support, maintenance and audit of software.

A.1.2 ISO/IEC 14143-2

A.1.2.1 SO/IEC 14143-2:

a) establishes a framework for the conformity evaluation of a Candidate FSM Method against the provisions of ISO/IEC 14143-1:1998,

b) describes a process for conformity evaluation of whether a Candidate FSM Method meets the (type) requirements of ISO/IEC 14143-1:1998 such that it is an actual FSM method, i.e. they are of the same type,

c) describes the requirements for performing a conformity evaluation in order to ensure repeatability of the conformity evaluation process, as well as consistency of decisions on conformity and the final result,

d) aims to ensure that the output from the conformity evaluation process is objective, impartial, consistent, repeatable, complete and auditable,

e) provides informative guidelines (refer Annex A of ISO/IEC 14143-2) for determining the competence of the conformity evaluation teams,

f) provides an example checklist (refer Annex B of ISO/IEC 14143-2) to assist in the conformity evaluation of a Candidate FSM Method, and

g) provides an example template (refer Annex C of ISO/IEC 14143-2) for the conformity evaluation report.

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Conformity evaluations are conducted by a conformity evaluation team that has the competencies described in ISO/IEC 14143-2. ISO/IEC 14143-2 assumes familiarity with the concepts and definitions described in ISO/IEC 14143-1:1998.

The conformity evaluation is performed by cross-referencing each component of a Candidate FSM Method against the corresponding provisions of ISO/IEC 14143-1:1998. The components of the Candidate FSM Method are then evaluated for their conformity.

The output from the conformity evaluation includes a decision for each provision evaluated. Only the requirements (shalls) are considered when determining if the Candidate FSM Method conforms to ISO/IEC 14143-1:1998. The recommendations (shoulds) of ISO/IEC 14143-1:1998 may also be investigated to provide additional information to end users of the Candidate FSM Method.

The output from the conformity evaluation process is the conformity evaluation report. The report may be used to:

a) inform end users that a Candidate FSM Method conforms to ISO/IEC 14143-1:1998 in accordance with ISO/IEC 14143-2, and is therefore an FSM Method, and

b) assist end users in making informed judgements about which method best suits their needs.

A.1.2.2 ISO/IEC 14143-2 may be used for first party (supplier), second party (user or purchaser) or third party (independent body), conformity evaluations.

NOTE The relationship between the owner, sponsor and evaluator depends on the type of evaluation that is performed, i.e. first, second or third party.

A.1.2.3 While conformance of a Candidate FSM Method to ISO/IEC 14143-1:1998 may be claimed without referencing ISO/IEC 14143-2, ISO/IEC 14143-2 provides a conformity evaluation process that may be used to add credibility to such claims. This part places requirements upon a conformity evaluation procedure and is usable for first, second or third party claims of conformance. Its provisions are particularly suitable for those who require third party conformity evaluation. Customers desiring to use or acquire an FSM Method evaluated for conformance in accordance with ISO/IEC 14143-2, should explicitly cite ISO/IEC 14143-2 when requesting the evaluation.

A.1.2.4 Conformity evaluation should not be construed as guaranteeing that the FSM Method is free from non-conformities; it only signifies that evidence of non-conformance was not found during the conformity evaluation process.

A.1.2.5 A Candidate FSM Method shall be determined as conforming if it successfully completes a conformity evaluation procedure which satisfies the requirements of sub-clause 4.4 of ISO/IEC 14143-2.

NOTE 1 Conformity of a Candidate FSM Method is based on evaluation against requirements of ISO/IEC 14143-1:1998. This part of ISO/IEC 14143 defines a process that may be used in evaluating whether a Candidate FSM Method conforms to the requirements of ISO/IEC 14143-1:1998.

NOTE 2 An International Standard on conformity evaluation or test methods, such as ISO/IEC 14143-2, does not imply any obligation to carry out any kind of test. It defines the process by which the evaluation, if required and referred to (for example in a regulation, or in contract documents), should be carried out.

A.1.3 ISO/IEC TR 14143-3

ISO/IEC TR 14143-3 establishes a framework for verifying the statements of an FSM Method and/or for conducting tests requested by the verification sponsor, relative to the following performance properties:

— repeatability and reproducibility;

— accuracy;

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— convertibility;

— discrimination threshold; and

— applicability to Functional Domains.

NOTE 1 Statements and test requests relative to other performance properties are outside the scope of this document.

It aims to ensure that the output from the verification is objective, impartial, consistent and repeatable. The verification report, produced as a result of applying ISO/IEC TR 14143-3, will enable the prospective users to select the FSM Method which best meets their needs.

NOTE 2 Verification of an FSM Method produces a result that indicates:

— the extent to which a performance property is exhibited, or

— whether a performance property is exhibited to a stated extent.

There is no concept of “pass” or “fail”. An FSM Method can be considered to be either “verified” or “not verified” for a particular performance property based on whether or not the appropriate verification has been conducted.

A.1.4 ISO/IEC TR 14143-4

ISO/IEC TR 14143-4 defines a reference model to be used when verifying a Functional Size Measurement method.

The reference model consists of two components:

— a classification framework of Reference User Requirements which should be sized using an FSM Method. Included are examples of such Reference User Requirements as well as references to further publications of User Requirements which can be used for Reference User Requirements, and

— guidance on selecting Reference FSM Methods, against which an FSM Method can be compared.

The Reference Model is an input to the evaluation process of an FSM Method. The formulation and execution of evaluation tests and the interpretation of their results is outside the scope of ISO/IEC TR 14143-4.

The Reference User Requirements and additional references contained in ISO/IEC TR 14143-4 only represent examples of User Requirements in some domains and situations. Additional Reference User Requirements and Reference User Requirements for domains and situations not covered by Annex A, B, or C of ISO/IEC TR 14143-4 may be generated with the assistance of the framework described in ISO/IEC TR 14143-4.

The requirements for Reference FSM Methods may assist in selecting Reference FSM Methods.

A.1.5 ISO/IEC TR 14143-5

ISO/IEC TR 14143-5 describes the properties of Functional Domains and the principles by which characteristics of Functional User Requirements (FUR) can be used to determine Functional Domains. Two models of implementing these principles to determine Functional Domains are provided in the Informative Annexes of ISO/IEC TR 14143-5.

Either of the models may be used directly, or using Functional Domains defined locally via the models:

a) by FSM Method users to determine if a particular FSM Method is applicable to the Functional Domain represented by their specific FUR;

b) to describe, for a given set of FUR, the Functional Domain to which the FUR belong; and

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c) by FSM Method owners and designers to describe the Functional Domain(s) to which the FSM Method can be applied as outlined in ISO/IEC 14143-1:1998.

The value of using the models of the Informative Annexes of ISO/IEC TR 14143-5 to specify Functional Domains is that it will allow comparisons of FUR from different sources and comparisons of the applicability of FSM Methods.

A.2 ISO/IEC International Standards of FSMMs

This section provides outlines of ISO/IEC 19761, ISO/IEC 20926, ISO/IEC 20968, and ISO/IEC 24570 from a purpose, fields of application or intended audiences, and limitations point of view.

A.2.1 ISO/IEC 19761

A.2.1.1 Purpose

This International Standard specifies the set of definitions, conventions and activities of the COSMIC-FFP Functional Size Measurement Method.

A.2.1.2 Fields of application

ISO/IEC 19761 is applicable to software from the following functional domains:

a) application software which is needed to support business administration;

EXAMPLE 1 Banking, insurance, accounting, personnel, purchasing, distribution or manufacturing.

NOTE Such software is often characterized as “data rich”, as its complexity is dominated largely by the need to manage large amounts of data about events in the real world.

b) real time software, the task of which is to keep up with or control events happening in the real world;

EXAMPLE 2 Software for telephone exchanges and message switching, software embedded in devices to control machines such as domestic appliances, lifts and car engines, for process control and automatic data acquisition, and within the operating system of computers.

c) hybrids of the above.

EXAMPLE 3 Real time reservation systems for airlines or hotels.

A.2.1.3 Limitations

This International Standard has not been designed for measuring the functional size of a piece of software, or its parts, which:

a) are characterized by complex mathematical algorithms or other specialized and complex rules, such as may be found in expert systems, simulation software, self-learning software and weather forecasting systems, or

b) process continuous variables such as audio sounds or video images, such as may be found, for instance, in computer game software, musical instruments and the like.

For such software it is possible, though, to define local customizations to the COSMIC-FFP measurement method.

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A.2.2 ISO/IEC 20926

ISO/IEC 20926 is based on the IFPUG function point practice manual release 4.1 unadjusted, using ISO/IEC JTC1 PAS procedure. ISO/IEC 20926 corresponds to the unadjusted Function Point of release 4.1.

A.2.2.1 Purpose

The primary objective of ISO/IEC 20926 is to:

— provide a clear and detailed description of function point counting, which is an alternative name for functional size measurement used by this method;

— ensure that function point counts, i.e., the functional size result of applying this method, are consistent among users of the method;

— provide guidance to allow function point counting from the deliverables of popular methodologies and techniques;

— provide a common understanding to facilitate automated function point counting.

A.2.2.2 Intended audience

ISO/IEC 20926 is designed to be applied by anyone using function point analysis for software measurement. It is designed for use by persons new to function point counting as well as those with intermediate and advanced experience.

A.2.2.3 Limitations

None is stated in ISO/IEC 20926 documentation.

A.2.3 ISO/IEC 20968

ISO/IEC 20968 is based on the MkII FPA Version 1.3.1, using ISO/IEC JTC1 PAS procedure.

A.2.3.1 Purpose

ISO/IEC 20968 provides a method for the quantitative analysis and measurement of information processing applications. It quantifies the information processing requirements specified by the user to provide a figure that expresses a size of the resulting software product.

A.2.3.2 Fields of application

ISO/IEC 20968 defines a method that assists in measuring process efficiency and managing costs for application software development, change or maintenance activities. It measures a software product size independent of technical characteristics of the software, in terms relevant to users. It can be:

— applied early in the software development process, and

— applied uniformly throughout the software's life time.

ISO/IEC 20968 can be used to measure the functional size of any software application that can be described in terms of logical transactions, each comprising an input, process and output component. The sizing rules were designed to apply to application software from the domain of business information systems, where the processing component of each transaction tends to be dominated by considerations of the storage or retrieval of data.

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A.2.3.3 Limitations

ISO/IEC 20968 may be applicable to software of other domains, but the user should note that sizing rules do not take into account contributions to size such as from complex algorithms as typically found in scientific and engineering software, nor do the rules specifically take into account real time requirements. To apply ISO/IEC 20968 to these other domains may be possible or may require extensions to or new interpretations of the rules given in ISO/IEC 20968.

A.2.4 ISO/IEC 24570

ISO/IEC 24570 is based on Version 2.0 of the manual "Definitions And Counting Guidelines For The Application Of Function Point Analysis," using ISO/IEC JTC1 PAS procedure.

A.2.4.1 Purpose

ISO/IEC 24570 attempts to provide a theoretical framework by presenting definitions and standard guidelines. It also tries to illustrate the counting guidelines as concretely as possible by using several practical situations.

ISO/IEC 24570 also gives two methods that estimate functional size to be used in earlier stages of software development.

A.2.4.2 Intended audience

ISO/IEC 24570 is meant for everyone who performs function point counts; i.e., both for people who count according to ISO/IEC 24570, and for those who use ISO/IEC 20926. For those using rules defined in ISO/IEC 20926, ISO/IEC 24570 can be a valuable supplement to ISO/IEC 20926 even though they have some differences. ISO/IEC 24570, after all, contains many hints, guidelines, and examples that can be of value to every ISO/IEC 20926 audience. It is assumed that the reader has some knowledge of ISO/IEC 20926. Nevertheless, the intention was also to produce as complete a manual as possible that includes sufficient introductory material and explanation for the new ISO/IEC 20926 audience or practitioner.

A.2.4.3 Limitations

None are claimed in ISO/IEC 24570 documentation.

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