TECHNICAL REPORT

ISO/IEC TR 14471

Second edition
2007-10-15

Information technology — Software engineering — Guidelines for the adoption of CASE tools

Technologies de l'information — Ingénierie du logiciel — Lignes directrices pour l'adoption d'outils CASE

Reference number
ISO/IEC TR 14471:2007(E)

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Contents

Page

Foreword iv
Introduction v
1 Scope 1
2 Terms, definitions and abbreviations 2
2.1 Terms and definitions 2
2.2 Abbreviations 2
3 Critical success factors (CSF) for adoption 2
4 Overview of CASE adoption 3
4.1 Preparation process 4
4.2 Evaluation and selection process 5
4.3 Pilot project process 5
4.4 Transition process 5
5 Preparation process 6
5.1 Setting goals 7
5.2 Verifying feasibility and measurability 8
5.3 Setting policy 8
5.4 Developing a plan 8
6 Evaluation and selection process 9
7 Pilot project process 10
7.1 Pilot initiation 11
7.2 Pilot performance 12
7.3 Pilot evaluation 12
7.4 Decision for a next step 13
8 Transition process 14
8.1 Initiation for transition 15
8.2 Training 16
8.3 Transition to routine use 16
8.4 Evaluation of adoption project and completion 17
Annex A (informative) Analysis of CASE adoption questionnaire 18
Annex B (informative) Cross reference for adoption process and critical success factors 20
Bibliography 22

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Foreword

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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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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 TR 14471, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This second edition cancels and replaces the first edition (ISO/IEC TR 14471:1999), which has been technically revised.

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Introduction

Historically, there have been problems experienced by organisations in adopting CASE (computer aided software engineering) tools. Because organisations have not gained the expected benefits of CASE technology, it is hoped that the use of a well-founded CASE adoption process will help achieve successful adoption of CASE tools.

A survey conducted by ISO/IEC JTC1/SC7/WG4 (See Annex A: Analysis of CASE adoption questionnaire) offers some hope that these problems may be improving. This survey suggests that CASE tools are performing new capabilities and getting easier to use, that users' expectations are getting more sophisticated, and that CASE tools are more likely to meet their goals. However, according to the survey, there remain a number of continuing problems. There has not been sufficient attention given to pilot trials of CASE technology before using it on actual projects, and users report a need for additional top management support, a total process for CASE adoption, and a preparation of the organisation for the introduction of the technology. This Technical Report addresses the continued needs reported by users.

The purpose of this Technical Report is to provide a recommended practice for CASE adoption. It provides guidance in establishing processes and activities that are to be applied for the successful adoption of CASE technology. The use of this Technical Report will help to maximise the return and minimise the risk of investing in CASE technology. However, this Technical Report does not establish compliance criteria.

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Information technology — Software engineering — Guidelines for the adoption of CASE tools

1 Scope

Since CASE adoption is a subject of the broader technology transition problem, this Technical Report addresses the adoption practices appropriate for a wide range of computing organisations. This Technical Report neither dictates nor advocates particular development standards, software processes, design methods, methodologies, techniques, programming languages, or life-cycle paradigms.

This Technical Report will:

— identify critical success factors (CSF);

— propose a set of adoption processes;

— guide successful adoption in consideration of organisational and cultural environment.

The following groups are targeted as potential audiences:

— CASE users;

— information systems managers;

— chief information officers (CIO);

— CASE suppliers;

— software engineering consultants;

— those involved in the acquisition of CASE tools and technology.

Therefore this Technical Report addresses aspects of CASE tools adoption. It is best used with ISO/IEC 14102 for CASE tool evaluation and selection. It is complementary to related ISO/IEC documents which deal with the general aspects of these topics.

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2 Terms, definitions and abbreviations

2.1 Terms and definitions

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

2.1.1
successful adoption
extent to which the use of CASE tools can measurably meet an organisation's uniquely defined adoption goals

2.1.2
adoption process
set of activities by which an organisation brings CASE tools into widespread use

2.1.3
CASE needs
organisational requirements which are met by CASE tool characteristics

NOTE These characteristics are detailed in ISO/IEC 14102:1995. They include management process, development process, maintenance, documentation, configuration management, quality assurance, verification, validation, environment needs, CASE tool integrability, quality characteristics, acquisition needs, implementation needs, support indicators, and certification requirements.

2.2 Abbreviations

CASE computer aided software engineering

CSF critical success factor

3 Critical success factors (CSF) for adoption

One of the primary goals of this Technical Report is to identify major factors which are critical to success in CASE adoption. A comprehensive set of technical, managerial, organisational, and cultural factors should be considered in order to successfully introduce CASE technology into an organisation. These factors should be monitored through the adoption processes when applicable. A cross reference table for the processes and the factors is provided in Annex B.

The following critical success factors are to be considered and evaluated.

a) Goal setting: The definition of a clear, measurable set of goals and expectations for CASE adoption, including both business and technical goals.

NOTE 1 Examples of measurable set of goals for CASE adoption might be “twenty percent increase of productivity in unit test activity”, “sixteen percent improvement of quality in requirements specification activity”, “fifty percent gain of reusability in object oriented design activity”, “sixty percent of projects should use CASE tools”, etc.

b) Management support: The extent to which high level management actively encourages CASE adoption, including but not limited to the willingness to allocate the necessary resources.

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c) Tool use strategy: The definition of a clear strategy for the scope of tool use.

NOTE 2 Examples of strategy might include tool use on a specific set of application types, use by a specific business component or corporate-wide use.

d) Total adoption process plan: A plan and design for the total process of bringing the tool into the organisational component.

e) Engagement: The extent to which the people involved in the adoption effort become active, motivated participants.

f) Methodology adjustability: The willingness and technical feasibility of adjusting, as necessary, existing organisational methods and typical methods of using the CASE tool so as to arrive at a single consistent set of methods.

NOTE 3 For example, existing process-oriented methods and candidate object-oriented programming tools might not be adjusted as a single consistent set of methods.

g) Training: Provision of the training and information necessary and appropriate at each step for each person involved in the adoption process.

h) Expert support: Provision of enthusiastic, expert tool use support during the pilot project and continuing as the tool moves into routine use throughout the organisational component.

NOTE 4 The experts (or champions) assigned to the pilot project, as a group, should have a combination of skills, including capability of being proponents for the new technology, experience in the tool use, experience in the process and procedures of the organisation, and influence within the organisation.

i) Pilot project: The performance of a controlled pilot project prior to the final adoption decision.

j) Tool capability: The technical capability of the tool, in its hardware and software environment, to satisfy the defined goals in the context of the intended scope.

k) Smooth changeover: Due consideration paid to ensuring the ability of the organisation to simultaneously operate in both the old and new methods until the entire organisational component has fully changed over to the new methods.

4 Overview of CASE adoption

This Technical Report will describe a set of adoption processes that can be used in a broad range of environments, where the definition of success can be tailored to the organisation. Successful CASE adoption requires more than casual adoption activities. This clause shows the major processes for adoption and the overview of the processes as shown in Figure 1. Adoption of CASE tools includes four major processes:

a) preparation process,

b) evaluation and selection process,

c) pilot project process,

d) transition process.

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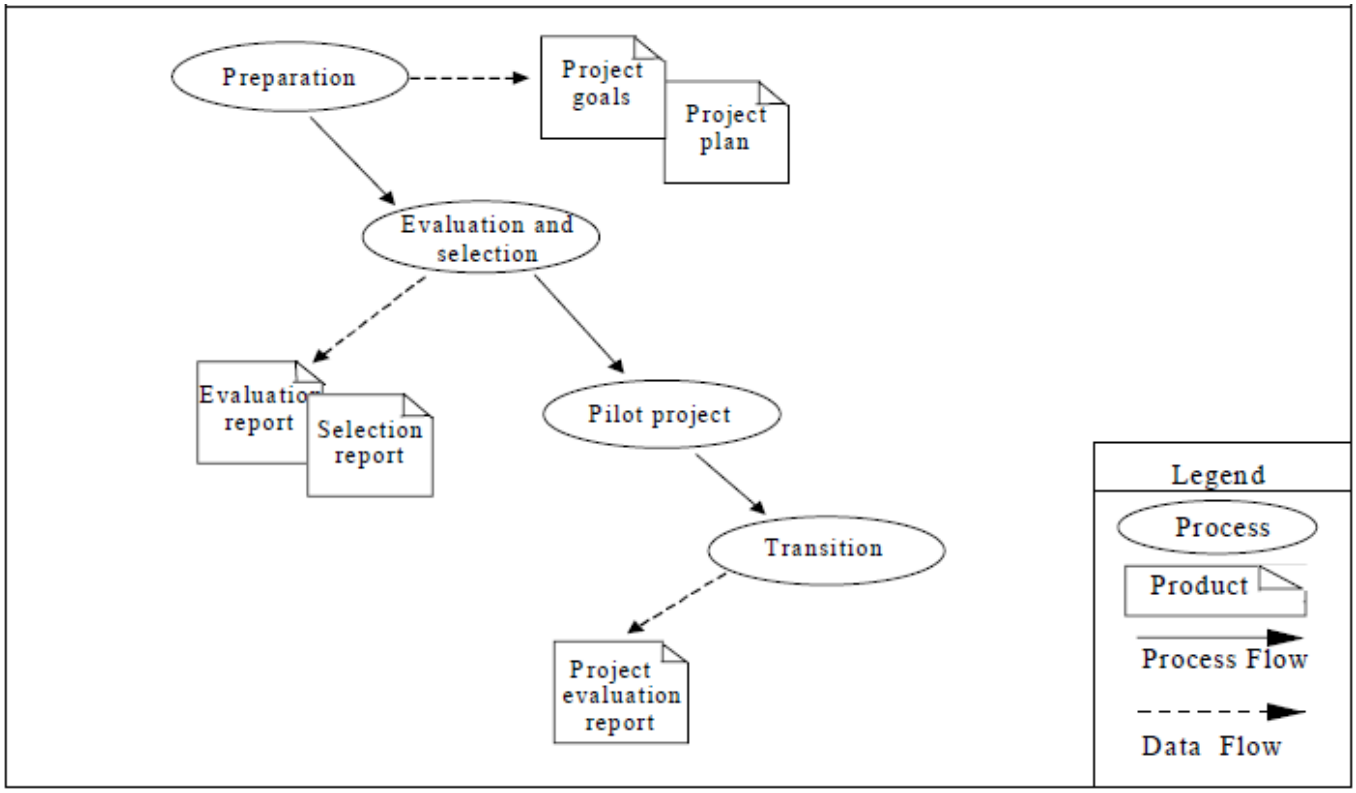

Figure 1 — The adoption process

4.1 Preparation process

The purpose of the preparation process is to establish the general objectives and goals of the CASE adoption effort, to establish the high level direction, and to define the management aspects of the effort (e.g., schedule, resources, cost).

The preparation process is composed of four activities:

a) Setting goals: identifies CASE adoption goals where CASE can help meet business objectives.

b) Verifying feasibility and measurability: develops and verifies technically and economically feasible and measurable subgoals for a CASE adoption project.

c) Setting policy: provides the rationale and general policy for adoption of CASE tools incorporating the critical success factors.

d) Developing a plan: produces a plan for the entire adoption project.

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4.2 Evaluation and selection process

The purpose of the evaluation and selection process is to identify the most suitable CASE tool(s) among the candidate tools, and to ensure that the recommended tool(s) meets the original goals.

The evaluation and selection process is fully defined in ISO/IEC 14102:1995, and is composed of following sub processes (activities):

a) Preparation: defines the objectives and requirements of the intended evaluation and selection of CASE tools.

b) Structuring: elaborates a set of structured requirements based upon the CASE tool characteristics in ISO/IEC 14102:1995.

c) Evaluation: produces technical evaluation reports that will be the major input for the selection sub process.

d) Selection: identifies the most suitable CASE tool(s) among the candidate tools.

4.3 Pilot project process

The purpose of the Pilot project process is to aid in validating the work performed in the earlier processes of CASE adoption process and to determine if the actual capability of the tool meets the organisational needs.

The Pilot project process is composed of four activities:

a) Pilot initiation: defines plans, procedures, resources, and training to perform a pilot project.

b) Pilot performance: executes a controlled project in which the newly acquired CASE tools can be tried out.

c) Pilot evaluation: provides the evaluation results of the performance of the pilot project.

d) Decision for a next step: decides whether to go ahead with the adoption process, abandon the tool or perform a second pilot project, and identify organisational learning experience for the transition process.

4.4 Transition process

The purpose of the transition process is to minimise disruptions during the changeover from the current processes to new technology based on the maximum use of the pilot project experiences.

The transition process is composed of five activities:

a) Initiation for transition: defines plans, procedures, and resources to perform transition and outlines, use of the tool.

b) Training: trains new CASE tool users.

c) Institutionalisation: progressively applies the tool to larger segments of the target environment until its use becomes part of normal organisational practice.

d) Monitoring and continuous support: identifies whether the adoption is in fact working, and ensures on-going training and other resources as needed during the transition period.

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e) Evaluation of adoption project and completion: measures the success of CASE adoption, and provides organisational learning experience for future adoption projects.

5 Preparation process

The first process in a CASE adoption effort is the preparation of CASE adoption goals and the project plan. Four major activities in the preparation process are:

a) setting goals,

b) verifying feasibility and measurability,

c) setting policy,

d) developing a plan.

Starting with the review of business objectives, CASE adoption goals will be defined and validated. A business objective is a higher level objective (e.g., improve competitive position of the organisation, increase productivity), which is not tied to any specific software engineering life-cycle objective. However, business objectives should be used to derive core (possibly alternate) sets of CASE adoption goals (e.g., improve process, improve design quality). These goals are related to software engineering life-cycle processes to ensure the effectiveness of the organisational functions and performances.

The activity of verifying feasibility and measurability examines the conformance of the business and CASE adoption objectives and it assesses technical and economic validity.

The activity of setting policy develops the direction for the remainder of the adoption process. In this activity, the critical success factors defined in Clause 5 should be tailored for a specific CASE adoption effort. Finally, the last activity in the preparation process is to organise a plan for the total process of bringing the tool into the organisational component. The overview of the preparation process in shown in Figure 2.

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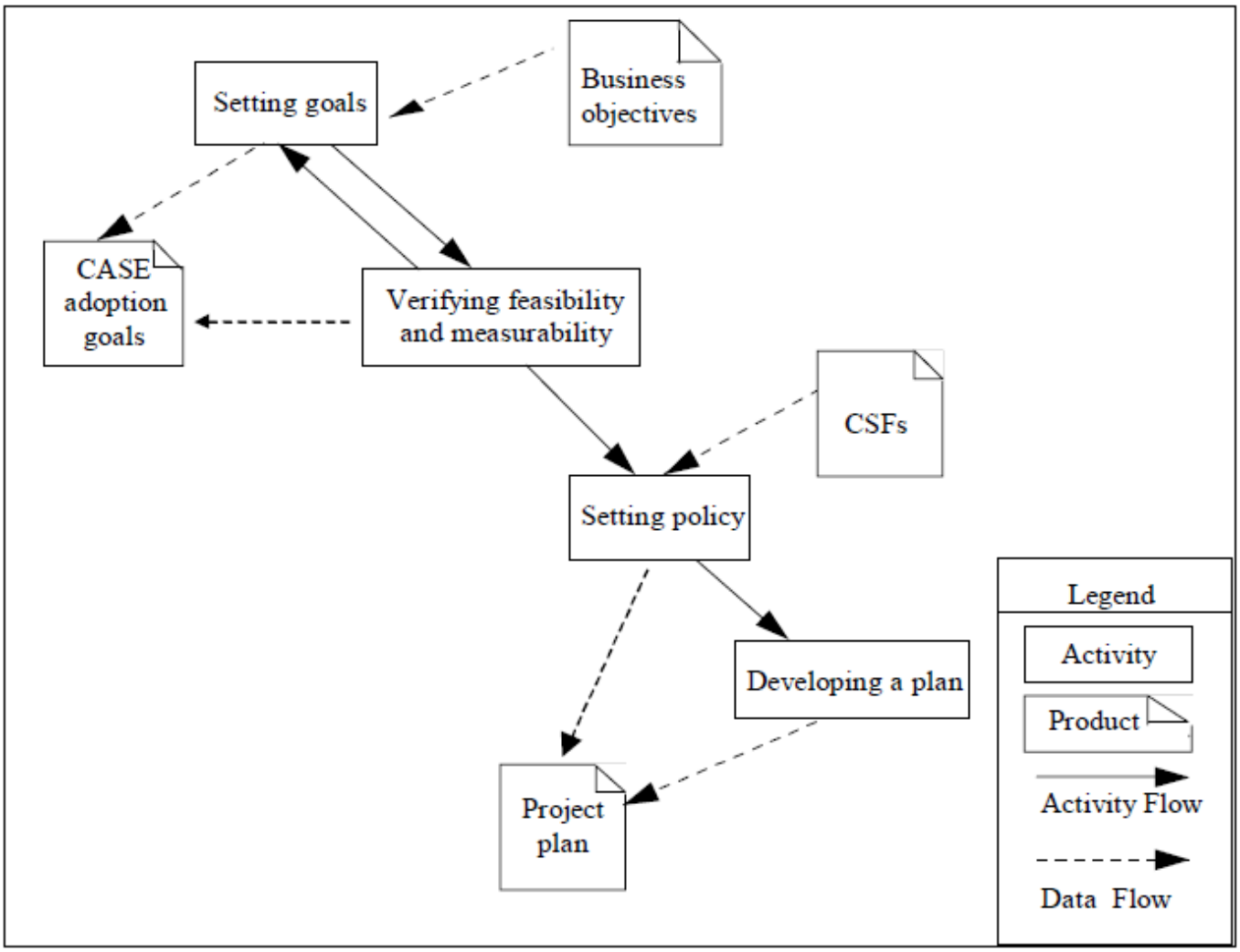

Figure 2 — Overview of preparation process

5.1 Setting goals

This activity includes the following tasks:

a) Review (existing) business objectives.

b) Review strategic impact of software engineering in the organisation or in the organisational component.

c) Decompose business objectives to the level of the strategic impact of software engineering.

d) Identify several alternatives by which CASE can help meet business objectives.

e) Ask “Where do we want to go?”.

f) Select and set CASE adoption goals from the alternatives.

g) Define and quantify the expectations of the CASE adoption effort based upon the goals.

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5.2 Verifying feasibility and measurability

This activity includes the following tasks:

a) Develop technically and economically feasible and measurable subgoals.

b) Perform competitor analysis (e.g., What technology are they using?).

c) Perform technical analysis (e.g., Is it technically achievable?).

d) Assess the organisation's current software engineering capability and maturity level.

e) Review current and near-term CASE state-of-the-practice.

f) Identify potential tools.

g) Ask again, " Where do we want to go?" (In a more precise way).

h) Identify specific subgoals and measures for them.

5.3 Setting policy

This activity includes the following tasks:

a) Ask "How can we achieve the CASE adoption goals?".

b) Identify the strategic roadmap of the adoption project.

c) Tailor the CSFs to meet business objectives and CASE adoption goals.

d) Provide a guide for the availability of resources (e.g., manpower, money, support).

e) Set a guide for monitoring and controlling the project.

5.4 Developing a plan

This activity includes the following tasks:

a) Organise a project team with assigned responsibilities.

b) Develop a set of steps to apply the CSFs in the appropriate process under the decided policies.

c) Identify a set of operational guidelines for the whole adoption process based upon the policies previously established.

d) Prepare a schedule of milestones, activities and their tasks, along with an estimate of resource requirements and a cost estimate.

e) Provide a means of monitoring and controlling the execution of the plan.

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6 Evaluation and selection process

This clause provides an overview of the evaluation and selection of CASE tools discussed in ISO/IEC 14102:1995 as shown in Figure 3. Evaluation and selection of CASE tools includes four major sub processes (activities):

a) preparation sub process,

b) structuring sub process,

c) evaluation sub process,

d) selection sub process.

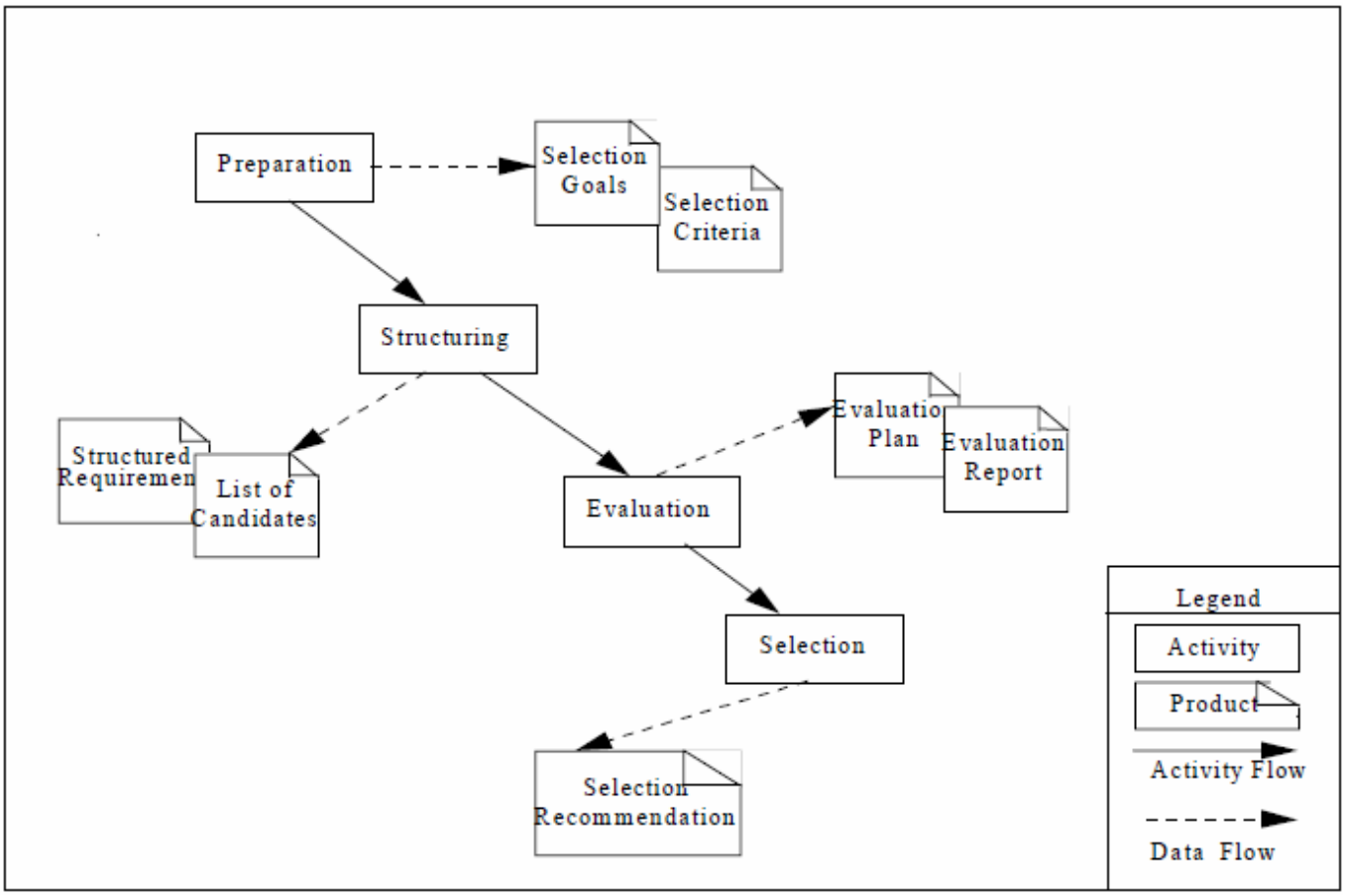

Figure 3 — Overview of evaluation and selection

A key step is the specification of a set of requirements against which candidate CASE tools are to be evaluated, and upon which selection decisions will be based. The CASE tool characteristics defined in ISO/IEC 14102:1995 form the basis for requirements structuring, and play a central role in the overall steps of the evaluation and selection process. In order to pursue this process for successful adoption, the steps in ISO/IEC 14102:1995 should be applied.

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7 Pilot project process

A pilot project process should be conducted to provide a realistic trial for the CASE tools in their intended environment. While the tool was exercised during evaluation and selection, that process does not require a realistic use of the tool. Evaluation and selection identifies the tool among the candidates with the most potential for the organisation. The pilot project aims to be sure it can really perform for the organisation in a real application.

The pilot will be typical of those used by the organisation, and will incorporate many of the features of the development projects for which the tool is intended. Staffing size should be typical for the project size. The personnel should be motivated problem solvers. At least one member of the team should have leadership qualities and have the respect of the technical staff. The pilot will be structured in order to objectively validate goals and strategies. However, it will be of limited scope and risk, and the duration of the project should be relatively short.

The purposes of the pilot are to:

a) validate that the tool in actual use can meet the general goals of the CASE adoption effort as well as any specific goals established for the pilot,

b) validate the evaluation and selection efforts and the experience and information gained during these efforts,

c) determine whether the tool meets the performance goals required, and whether it is appropriate for use within the organisation,

d) estimate the costs and benefits of the tool in a full production environment,

e) identify the appropriate scope of use within the organisation,

f) determine any necessary modifications to existing methods based on the use of the tool,

g) gather the information necessary to assist in the development of a transition plan (see Clause 9),

h) develop in-house experience in all aspects of the use of the tool,

i) provide data required to make an adoption decision.

Specific criteria are established to measure how well the tool meets user needs. An important function of the pilot is to act as a decision point during which the organisation can affirm or reject the decision to purchase the tool.

Failure of a pilot to meet expectations provides a crucial piece of information that allows an organisation to avoid much wider and more expensive failures, since a pilot usually involves the purchase of fewer copies of the tool and the training of fewer people. As shown in Figure 4, the activities to be performed during the pilot project process include:

1) pilot initiation,

2) pilot performance,

3) pilot evaluation,

4) decision for a next step.

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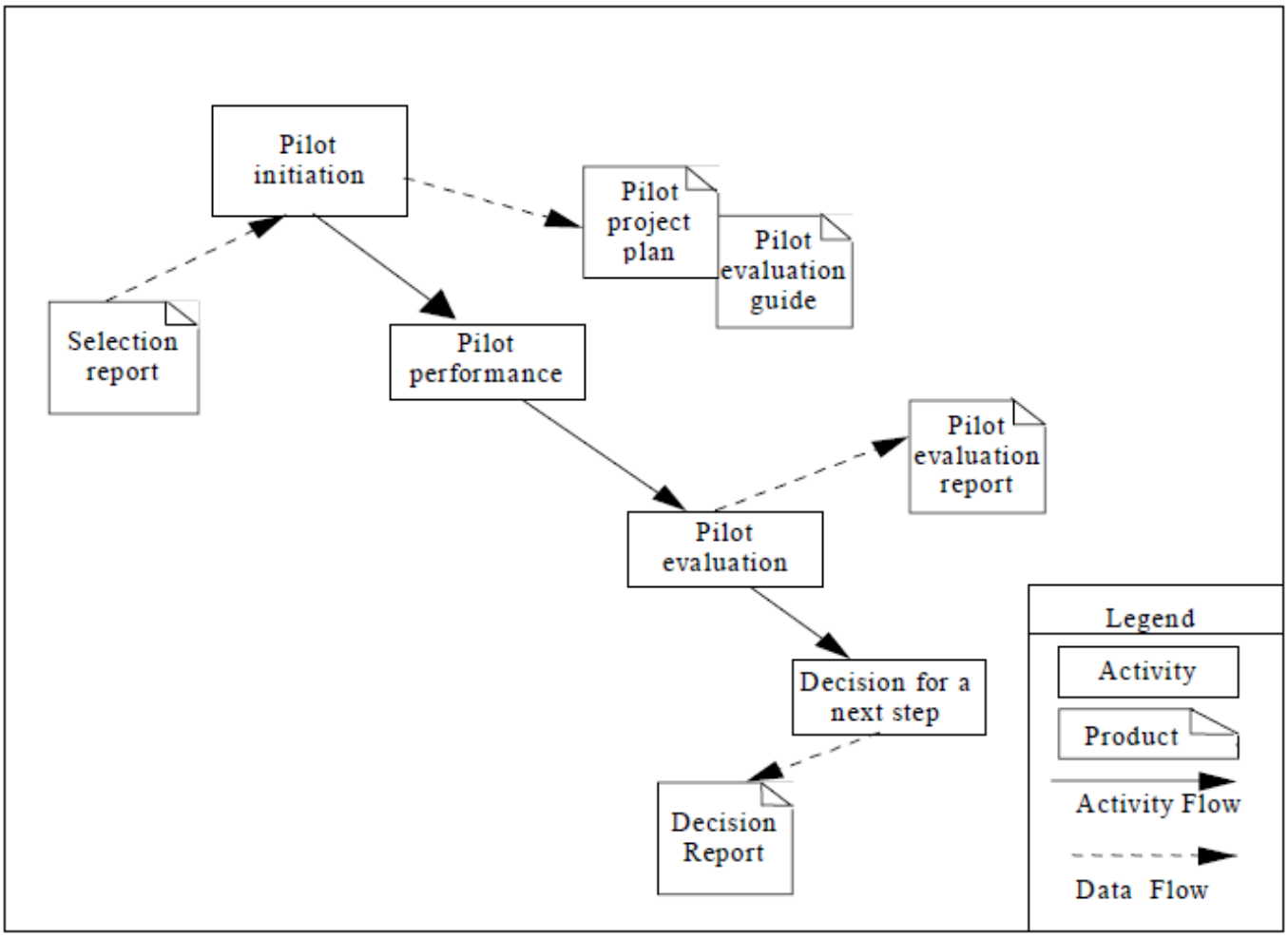

Figure 4 — Overview of the pilot project process

7.1 Pilot initiation

This activity includes the following tasks:

a) Define the objectives of the pilot project based upon the selection report and CASE adoption goals.

b) Determine the pilot project characteristics. These should include domain and scope of verification, size of the project, representativeness and scalability of the project, project duration based upon the project objectives, criticality and risks involved, and resources constraints (e.g., manpower, money, time).

c) Identify evaluation criteria and metrics to be used to determine whether to go ahead with the adoption process, to abandon the tool, or to perform a second pilot project. Sample criteria could include goal achievability, tool capability, and methodology adjustability.

d) Identify and plan for the resources necessary for completion of all aspects of the pilot project. Resources identified should include personnel, hardware, related software, expert support, management support, and funding.

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e) Acquire the CASE tool(s) based upon the selection decision, install it in the production environment, and customise it to the degree necessary for the pilot effort.

f) Define the procedures, standards, and conventions which will govern the use of the tools during the pilot project. Where the organisation has existing procedures, standards, and conventions, they should be tailored for the pilot project.

g) Identify the types and quality of training necessary for the pilot project. This should provide input and be coordinated with the long term training plan to be developed as part of transitioning of the tool to routine use.

7.2 Pilot performance

This activity includes the following tasks:

a) Perform the pilot project in a controlled, or laboratory environment in which the newly acquired CASE tool(s) can be tried out.

NOTE Typically a controlled or laboratory environment can be established where the research outcomes, process, and conditions (pre/post) can be measured and monitored.

b) Resolve any problems encountered during the pilot project performance in order to maintain a positive attitude, and let the personnel who participate in this pilot project be aware of the fact that uncertainties are expected, and are a part of this approach.

c) Prepare readiness for the maintenance and update of tools during the pilot project. Since the field of software engineering is dynamic, CASE tool users should cope with occasional updates to the vendor's products.

d) Utilise appropriate support from capabilities including vendor hotlines and local vendor support, internal support form CASE experts, access to experienced users in other organisations, and tool user groups.

e) Perform periodic reviews based upon the predefined evaluation criteria and metrics. The reviews serve as intermittent measures for progress of the pilot project. More importantly, this data will be the basis for the next two activities: pilot evaluation and decision.

7.3 Pilot evaluation

Evaluation criteria include:

a) achievability of CASE adoption goals,

b) tool use strategy,

c) tool capability,

d) methodology adjustability,

e) performance of the pilot,

f) smooth changeover,

g) vendor support.

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This activity includes the following tasks:

1) Identify and schedule all tasks and subtasks (e.g., measurement, rating and assessment) which must be performed as part of the pilot evaluation activity.

2) Prepare data sets necessary for the pilot evaluation based upon the predefined evaluation criteria and metrics.

3) Apply rating and assessment value for each evaluation criteria.

4) Perform pilot evaluation.

5) Prepare evaluation report. The report should include: evaluation results, potential problems and significant features of the pilot that can affect the usefulness of the tool to the organisation, projects or units within the organisation for which the tool is appropriate. In addition, information about improving the tool adoption process for the future should be included.

7.4 Decision for a next step

The organisation should decide whether to go ahead with the adoption process, abandon the tool or perform a second pilot project. At this point in the tool adoption process, the organisation has made a substantial investment. The organisation has executed its tool selection process, purchased the tool, trained personnel in the use of the tool and used the tool in a pilot project. If the pilot project could satisfy the CASE adoption goals and could meet the critical conditions of evaluation criteria, the organisation can move to the transition process.

However, the tool may have failed to even minimally meet the organisation's needs in the pilot project. If the pilot project fails in its goals, the organisation should learn from that failure. The pilot project may have failed because the tool was inappropriate for the functions it was intended to perform. Under those conditions, the organisation needs to reconsider its selection process. The definition of the organisation's requirements may not describe its actual needs. Under those circumstances management and tool users need to reconsider how the organisation defines its requirements. Other reasons for the pilot project's failure can include inadequate training, an inappropriate project, or insufficient resources for start-up.

The organisation should only consider the third option (to perform a second pilot project) if there exists a high probability for achieving the CASE adoption goals by resolving some open issues. The second pilot project should be designed to answer those open issues. An example of decision alternatives is shown in Table 1.

A new product (offering additional functionalities or better functionalities, or tending to become a de facto standard), may appear on the market before the final adoption decision is made. This may lead to reiterating part of (or the whole) the evaluation/selection process, even if the pilot project has been successfully completed.

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Table 1 — An example of decision alternatives

Alternatives	Applicable conditions	Potential actions
Adopt the tool	Can achieve a satisfactory level of CASE adoption goals Have met all critical conditions of evaluation criteria Have demonstrated high probability of successful wider scale tool use	May consider incremental approach (even if pilot project shows positive results, it may not be enough to ensure the globalisation) Move to the transition process
Abandon the tool	Cannot achieve a satisfactory level of CASE adoption goals Cannot meet the critical conditions of evaluation criteria Have not demonstrated a reasonable probability of success in wider scale tool use	Investigate the reasons for the failure (e.g. requirements definition, selection of wrong tools, inappropriate pilot project, etc.) Learn from the failure experience and update organisational CASE adoption process.
Perform a second pilot	May achieve a satisfactory level of CASE adoption goals if some unresolved questions are clarified May meet the critical conditions for evaluation criteria if some remedial efforts are exerted	Should design the second pilot project to answer those unresolved question Improve the whole pilot process based on the first pilot experience

8 Transition process

An organisation should adopt the tool where it can provide benefits within the organisational components. The last process in the CASE adoption effort is the transition and routine use of the tool within those components. The primary objective of this process is to achieve smooth changeover from current practices to new technology based on the maximum use of the pilot project experiences. Major activities during transition to routine use include:

a) initiation for transition,

b) training,

c) institutionalisation,

d) monitoring and continuous support,

e) evaluation of adoption project and completion.

The overview of the transition process is shown in Figure 5.

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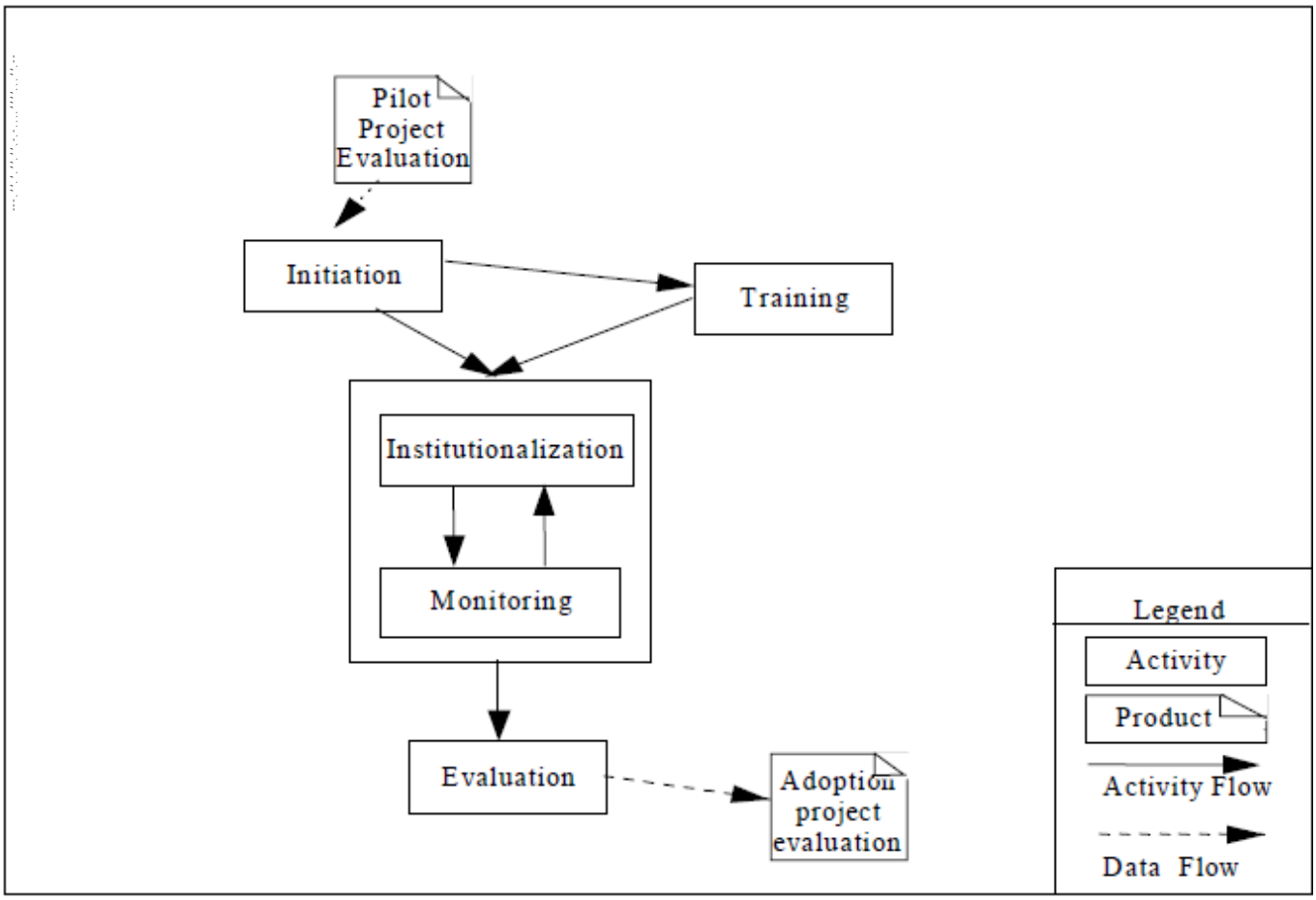

Figure 5 — Overview of the transition process

8.1 Initiation for transition

The initiation activity should consist of the following tasks:

a) Set up transition strategy (e.g., big bang, incremental) and choose right project(s) for use of the tool.

b) Prepare a transition plan of milestones, activities and their tasks, along with an estimate of resource requirements and a cost estimate.

c) Prepare communication and promotion plan for the proper dissemination of information.

d) Select the personnel for the transition process. Pilot project participants (especially champions) should be available to share information about the new tool capability and lessons learned in effective tool usage with the rest of the organisation.

e) Acquire tool(s) on wider scale based on the pilot project evaluation results.

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f) Use management support to resolve organisational and/or cultural issues during the transition process (e.g., resources allocation such as manpower and money, timely decision, conflict resolution, and process reengineering).

g) Prepare a training schedule. The training schedule should include the designation of the personnel to be trained as well as the training they are to receive.

8.2 Training

Training activity includes initial training for a group of early users as well as the continual upgrading of existing employee's skills. It also includes training the system administrators who must support the tool's usage in the organisation, including help desk functions and integration of the tool with other tools.

Training that applies across the span of the transition process should occur as close as possible to the task start date. Training for a tool, process, or method that is not used until several months after the start of the transition process should be performed just in time for its actual use.

In addition to basic training for a tool, process, or method, training should assist personnel in converting from old practices to new practices. The end users, who may participate in the development or may be involved in the use of products from the CASE tool, should be included in the training program. Training may also be necessary for new practices concerning accounting or cost/schedule estimation.

8.3 Transition to routine use

For a successful and cost effective transition, an infrastructure for incorporating the current practices with the new technology should exist. CASE tool routine use can include the indoctrination of qualified new employees into the system and the continual upgrading of the skills of existing employees.

An organisation should not underestimate the resources necessary to maintain routine use of complex CASE tools. Many CASE tools require experienced personnel capable of managing the tool databases (or repositories) and responding to problems.

The transition to routine use of the tool begins with institutionalisation followed by monitoring and continuous support.

8.3.1 Institutionalisation

Institutionalisation includes the following tasks:

a) Transition of people from current practices to new practices: The participants in the pilot who received the early training may be enthusiastic and highly skilled CASE tool pioneers eager to try the new technology. However, future developers may require more extensive training in using the tool.

b) Integration of tools and methodology: This task includes integration of the tool(s) with existing tools and integration of the tool(s) into the organisation's development methodology.

c) Setting up procedures: The transition activity should define the procedures for tool use (e.g., procedures for quality assurance and acceptance processes including the timing of reviews and the methodologies to be used, and procedures for integration with existing tools and repositories).

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d) Define transition roles within the organisation: Because the transition effort involves cultural change, it is important to identify and manage the needs of key roles throughout the effort. These roles include those of top level management, change agents, and target groups.

e) Consistency in applying the CASE tool: The use of standard procedures will enable a smooth transition between software life cycle phases. Existing practices should be considered before adopting new ones.

8.3.2 Monitoring and continuous support

Continuous monitoring and assessment of the transition to routine use step is essential to identify whether the adoption is in fact working, and to provide early warning if something is wrong.

To determine how effectively a new CASE tool increases productivity/quality and achieves organisational goals, a measurement system is required. For this, a baseline measurement of the current system should be performed prior to tool adoption. An organisation should maintain consistent data gathering procedures over time. The data should include the responses of tool users.

Management support, expert (champion) support, resources support, and on-going training should be continuous during the transition and routine use period.

8.4 Evaluation of adoption project and completion

This final activity of the adoption process should evaluate the results of the performance of the adoption project to the original definition of the organisation's needs and expectations. The outcome of this step should measure how much the adoption project is successful, and identify the significant features of the adoption project, and provide information for improving the adoption process for future adoption projects in the organisation.

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Annex A
(informative)

Analysis of CASE adoption questionnaire

A survey was prepared to understand how CASE tools have been used in organisations. The questionnaire sought feedback on the goals and characteristics of CASE adoption efforts, as well as the factors that are critical to their success. The surveys were distributed through member countries in early 1995. The results are summarized below. The figures in Annex A are mainly intended to indicate general trends. They must not be considered for their actual values, but rather for the tendencies they show.

A total of 41 responses were obtained. The typical respondent was a project manager for an MIS (Management information system) organisation, on a medium sized project (20-100 engineers). The focus of the CASE adoption efforts tended to be on a set of projects, focusing on multiple phases, integrating several tools.

The primary goals which respondents cited were:

a) Quality improvement 83%
b) Productivity 72%
c) Maintainability 52%

The decision maker on CASE selection and adoption tended to be a project manager, with support from top level managers. Most projects performed moderate planning for the CASE adoption effort. Only about one third of the projects used a pilot project before full implementation.

When asked to rate the success of their projects, 70% indicated at least partial success. This fact is encouraging. It may indicate that projects are achieving more success than in previous years, or the survey respondents may have been self selected. Respondents were also asked to rate the ease of the tool use. About half rated the tool as being of neutral difficulty; one third rated the tool as being "easy", and 16% rated the tool as "difficult". While early CASE tools were perceived to be difficult to use, this may indicate that the current generation is easier to use or that users have become accustomed to their capabilities and interfaces.

Almost 80% of respondents indicated that as a result of the CASE adoption effort, they made changes to their process. This indicates that the respondent organisations are attempting to examine the interaction between tools, process and methods.

A set of potential critical success factors for the use of CASE tools were identified. Respondents were asked to rate each factor in terms of:

1) the extent to which they used the factor, and

2) its overall importance.

These ratings were on a five point scale ranging from "little" (1), to "very much" (5).

In order to understand the overall trends, the positive categories on the five point scale ("4" and "5") were combined to indicate strong "use" and strong "importance". The first analysis examined the extent to which respondents used each factor in their actual implementations. The results are summarized below:

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Major factors used in actual efforts:

a)	Tool capability	70%
b)	Goal setting	67%
c)	Technical quality	60%
d)	Management support	60%
e)	Expert support	60%
f)	Tool use strategy	50%

These results cluster in two main categories: 1) tool characteristics, and 2) goals, strategy, and support. Both the technical quality of the tools and management support for them seem to be critical factors for the effective implementation of CASE tools.

The major factors which received ratings for importance (independent of actual use) are listed below:

a)	Management support	80%
b)	Goal setting	75%
c)	Engagement	72%
d)	Tool capability	72%
e)	Training	62%
f)	Tool use strategy	58%

The overall trends between the "importance" of the factors and the actual "use" of a factor are similar. However, there are some differences which are worth noting. The technical tool characteristics (tool quality and tool capability), had higher ratings for "use" than for "importance". While management support and goal setting are acknowledged as important both theoretically and in actual use, respondents appear to focus somewhat more on tool characteristics when actually involved on a project. In addition expert support is one of the major critical success factors in the actual implementation of a project, but did not receive as much weight in the rating of "importance" independently of actual use on a project.

Several implications of this survey include the following:

a) Respondents seem to be satisfied with the technical characteristics of the tools. This is in contrast to the past when tools appeared to be more immature. The technical capability of the tools appears to provide one important precondition for the successful adoption of tools.

b) As shown in the ratings of the critical success factors, the cluster of goals, strategy and support represents a major component of a successful CASE adoption effort. The groundwork for increased awareness of the importance of these factors has been set up. There seems to be some planning for the adoption efforts in terms of changes to process and methods. The longer term goals of quality improvement and long term maintainability were rated highly in addition to the shorter term goal of productivity improvement. However, the actual use of a systematic plan for adoption appears to be uneven. For example pilots are used in only a third of cases. This Technical Report fills part of the gap by providing a disciplined approach for CASE adoption.

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Annex B
(informative)

Cross reference for adoption process and critical success factors

		Goal setting	Management support	Tool use strategy	Total adoption process plan	Engagement
Preparation	Entry	Business objectives	Critical success factor	CASE adoption goal	critical success factors	critical success factor
	Action	goal formulation	get approval	develop strategy	develop plan	develop plan
	Exit	CASE adoption goal	Management support policy	tool use strategy	project plan	engagement plan
Evaluation and selection	Entry	CASE adoption Goal	support policy	tool use strategy	project plan	engagement plan
	Action	evaluation and selection goal setting	support eval. and selection	apply tool use strategy	perform planned activity	motivate engagement
	Exit	goal validation	evaluate management support	updated tool use strategy	plan vs. actual	evaluate engagement
Pilot project	Entry	CASE adoption goal	support policy	updated tool use strategy	project plan	engagement plan
	Action	pilot project goal setting	support pilot project	apply updated strategy	perform planned activity	motivate engagement
	Exit	goal validation	evaluate management support	final tool use strategy	plan vs. actual	Evaluate engagement
Transition	Entry	CASE adoption goal	support policy	final tool use strategy	project plan	Engagement plan
	Action	Transition goal setting	Support transition	apply strategy	perform planned activity	motivate engagement
	Exit	measure goal achievement	Evaluate management support	measure success	adoption project evaluation	evaluate engagement

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		Methodology adjustability	Training	Expert support	Pilot project	Tool capability	Smooth changeover
Preparation	Entry	Critical success factor	Critical success factor	Critical success factor	Critical success factor	Critical success factor	Critical success factor
	Action	develop plan	develop plan	select expert	develop plan	develop criteria	develop plan
	Exit	Adjustment plan	training plan	Support plan	pilot project plan	tool capability criteria	transition plan
Evaluation and selection	Entry	Adjustment plan	training plan	Support plan	pilot project plan	list of candidates	-
	Action	Review methodology	Develop training materials	Support activity	Develop evaluation guide	review tools	-
	Exit	Adjustment guide	Training materials	Evaluate support	pilot project evaluation guide	selected tools	-
Pilot project	Entry	Adjustment guide	training plan	support plan	pilot project plan	selected tools	transition plan
	Action	Perform adjustment	training	support activity	perform pilot project	tool use	evaluate transition plan
	Exit	Evaluate adjustment	Evaluate training	Evaluate support	Decision Report	Evaluate Capability	updated transition plan
Transition	Entry	Updated adjustment guide	training plan	support plan	-	adjusted capability	pilot project experience
	Action	Perform adjustment	training	support activity	-	tool use	perform transition
	Exit	Evaluate adjustment	Evaluate training	Evaluate expert support	-	Measure success	adoption project evaluation

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