The Effect of Task and Tool Experience on Maintenance CASE Tool Usage

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ABSTRACT

Computer-aided software engineering (CASE) tools have been advocated for improving maintainer productivity and the quality of maintained software. While there is evidence that such benefits can accrue to organizations adopting maintenance-oriented CASE tools, a key problem in achieving the desired benefits from CASE tools is low usage of these tools by programmers. The previously tested Maintenance Tool Utilization Model was a first step in investigating the factors that affect whether maintainers choose to use CASE tools during maintenance projects. We test the addition of experience with software maintenance tools and with the software maintenance task to the Maintenance Tool Utilization Model. The role of experience is important because managers can provide training to increase experience and they can ensure that project teams have some members experienced with the tools or with the task. Data for the test are collected from software maintainers working on their organization’s normal maintenance project backlog. Tool experience is significant as both a main and interaction effect, but task experience adds little to the explanatory power of the Maintenance Tool Utilization Model. These results support the value of improved CASE tool training programs.

Keywords: Baseline Maintenance Tool Utilization Model; Computer-Aided Software Engineering (CASE), Maintenance Tool Utilization Model

INTRODUCTION

Organizations are adopting Computer-Aided Software Engineering (CASE) tools to support maintenance tasks. Software maintenance is the process of changing existing, production software. Production software is changed to correct problems, to adapt the system to a changing hardware and software environment, and to improve the system by making it more efficient or by adding functionality for users (Swanson & Beath, 1989). Maintenance-oriented CASE tools provide software tool support for the maintenance process. Such tools have been identified as a key to achieving maintenance productivity gains (Schneidewind, 1987). In addition to improving productivity, the use of these tools may contribute significantly to improving the quality of the software being maintained (Kim & Westin, 1988).

If CASE tools are used, productivity and quality benefits are being achieved (see Iivari, 1996, for a brief review of this literature). The problem, however, is low utilization of these tools (Iivari, 1996; Kemerer, 1992). Since CASE tools that
are not used will have no effect on main-
tainer productivity or software quality, posi-
tive or negative, some amount of utilization
is required for benefits to accrue to the or-
ganization. While some argue that too much
utilization does not provide additional ben-
efits, few would argue that overuse of soft-
ware maintenance tools is currently a prob-
lem. Low tool utilization is the practical
problem organizations adopting CASE tools
now face. Tool utilization is the outcome
measure used in this study.

The software maintenance process
consists of two major steps, understanding
the existing production system and modifi-
cation of this software (Pennington &
Grabowski, 1990; Yau & Collofello, 1985).
The software maintenance support tools of
interest to us are generally intended to sup-
port program understanding. Such tools are
of interest because maintenance program-
ners spend 50-90% of their time under-
standing the program (Shaft & Vessey,
1998). If tools could help in the under-
standing process, the potential for significant pro-
ductivity enhancements is large. These
tools assist the programmer/analyst in dis-
covering the physical and logical designs
of the program or system at hand. The
discovery of impacts of a proposed change
on “distant” programs, i.e., programs linked
by common data elements, is an important
part of this phase, and is assisted by these
software tools.

Software maintenance support tools
may also contain functionality that facil-
itates the coordination of programmers on
a large project. Such functionality is pro-
vided by a variety of schedule and project
management programs, and includes com-
munications programs such as e-mail, and
audio and video conferencing.

This research study extends previous
work that developed a Maintenance Tool
Utilization Model (Dishaw & Strong,
1998b). The Maintenance Tool Utilization
Model is based on the task-technology fit
(TTF) literature (e.g., Goodhue, 1995;
Goodhue & Thompson, 1995). The argu-
ment of TTF-based models is that software
tools will be used if they fit the needs of
the task. The utilization of maintenance-
oriented CASE tools can be explained by
TTF-based models (Dishaw & Strong,
1998a, 1998b). Fit between maintenance
tool functionality and the needs of the main-
tenance task, however, is only part of the
reason a maintainer chooses to use, or not
to use, maintenance tools for a particular
maintenance project. Other variables are
likely to affect a maintainer’s decision to
use a tool.

Of particular interest is the role of
experience with CASE tools in explaining
tool utilization (Guinan, Cooprider, & Saw-
yer, 1997; Thompson, Higgins, & Howell,
When purchasing tools, managers may fail
to invest sufficiently in training for poten-
tial tool users. If tool experience is critical
to utilization decisions, it has implications
for how management implements mainte-
nance-oriented CASE tools. In particular,
training may be an important component
of successful CASE tool adoption.

In the MIS literature, task experience
is also considered to be an important vari-
able (Mackay & Elam, 1992; Shaft & Vessey,
1995). If task experience is critical
for utilization decisions, management
must consider the maintenance experience
profile of their maintenance staff when
making decisions on purchasing mainte-
nance-oriented CASE tools.

In this study, the Maintenance Tool
Utilization Model is extended to include tool
and task experience variables. The effect
of these additional variables on main-
tenance tool utilization is tested to determine
their contribution to utilization beyond that

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