

Experiences with the use of CASE-tools in the Netherlands

G.M. Wijers

Delft University of Technology
Faculty of Technical Mathematics and Informatics
Department of Information Systems
P.O. Box 356, 2600 AJ Delft, The Netherlands

and

H.E. van Dort

Cap Gemini Pandata
P.O. Box 3164, 3502 GD Utrecht, The Netherlands

Abstract

In April of 1989 the working group "Experiences with the use of CASE-tools" of the Dutch User Group of Structured Development Methodologies conducted an inquiry into the use of CASE-tools among 834 Dutch organizations. This paper presents the most interesting results of this survey. The results are grouped into five major sections: the characteristics of CASE-tool users, the selection criteria for CASE-tools, the implementation in organizations, the actual usage of CASE-tools and future expectations for the use of CASE-tools.

1. Introduction

The Dutch User Group of Structured Development Methodologies (in Dutch: "NGGO") was established at the end of 1985 to be a forum for organizations that use structured methodologies, like those published by Yourdon (1989), Ward and Mellor (1986) and Hatley and Pirbhai (1987). Since the outset, many NGGO-members have been very interested in CASE-tools. The NGGO produced a report that contained an overview of the characteristics of the main CASE-tools on the Dutch market (NGGO, 1988).

As an usergroup the NGGO is particularly interested in the practical experiences of users with CASE-tools. For this reason they tried in 1986 to establish a working group to record the experiences of CASE-tool use. This attempt failed because it appeared that the use of these tools was very limited at the time.

In September 1988 a new working group was established. This time it resulted in a survey of 834 organizations that use CASE-tools. The findings of these were published in September 1989 (NGGO, 1989), both authors of this paper were members of the working group. The current paper discusses the purpose and structure of this survey together with the major results.

The results presented give a general picture of the use of tools in the Netherlands. The results of the three most popular tools will be presented separately where interesting. These three tools are: SDW, which stands for "System Development Workbench", a relative new CASE-tool of Dutch origin (Cap Gemini Pandata), Excelerator a world-wide well known workbench from "In Tech" (USA) and IEW, the "KnowledgeWare" (USA) workbench that supports the Information Engineering Methodology.

2. Structure of the study

The purpose of the working group was to make an inventory of the experiences of Dutch CASE-tool users. In this paper "user" is defined as an organization in which CASE-tools are being used and "CASE-tool" as a software product which, at least during analysis and design, contributes to the construction of the required specifications. Examples of CASE-tools are apart from the three already mentioned: IEF, Promod, Prokit, Graphdoc, Teamwork, Blues, Design/1, PSL/PSA, ISEE, ProNiam, BOIE, Yourdon A/D Toolkit, Maestro, etc.

A questionnaire was considered to be the most appropriate way to reach as many users as possible. A mailing list was compiled, based on addresses obtained from CASE-tool vendors and addresses gathered by the NGGO of organizations interested in CASE-tools. The list finally comprised the addresses of 834 organizations. The results of the survey have been analyzed using SPSS/PC+ and Graph-in-a-Box.

The questionnaire was divided into several sections, each covering a different part of the life cycle of a CASE-tool. A multiple-choice question format was adopted. This resulted in a 12-page questionnaire divided into seven sections:

- Introduction

Explanation of the purpose of the survey plus some instructions for the respondent.

- Background information

Questions about the line of business, the size of the organization and about the number and kind of CASE-tools available in the organization (see section 3).

- The selection process

Questions about reasons for purchase and the means of selection (see section 4).

- Implementation of the CASE-tool in the organization

Questions about how the CASE-tools were introduced in the organization (see section 5).

- Use of the CASE-tool in the organization

Questions about the impact on design-process and the opinion of users on the different aspects of the CASE-tool, such as: price, consistency checks, ease of use, documentation, etc.

- Expectations for the future

Questions about the planned use of CASE-tools in the next two years.

- General remarks on the questionnaire

An open question to get an impression whether the questionnaire was both complete and correct of the questionnaire.

3. Profile of the Dutch CASE-tool users

In this section we discuss the entire response and the size of the organizations using CASE-tools.

3.1. Response

Of the 834 questionnaires sent, 237 were returned and used in this analysis, which corresponds with a response-rate of 28.6 %. The response-rate for the individual CASE-tool is shown in figure 1. The results were checked to see whether they were influenced by the source of the address. It appeared that the division between brands did not differ significantly between addresses supplied by vendors and those compiled by the NGGO. This confirms that the inquiry gives a reliable indication of the experiences of organizations that use CASE-tools.

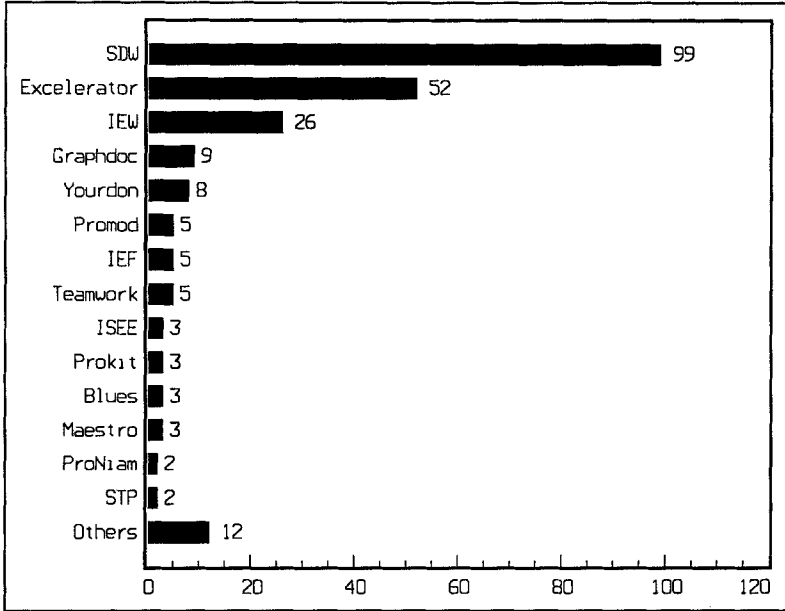


Figure 1 Response by brand in numbers

3.2. Size of organizations

From figure 2 it is clear that large organizations, in particular, use CASE-tools: 63.1 % of the organizations employing more than 500 peoples. If the figures for software houses/consultancy organizations are ignored this figure rises to 73.0 %.

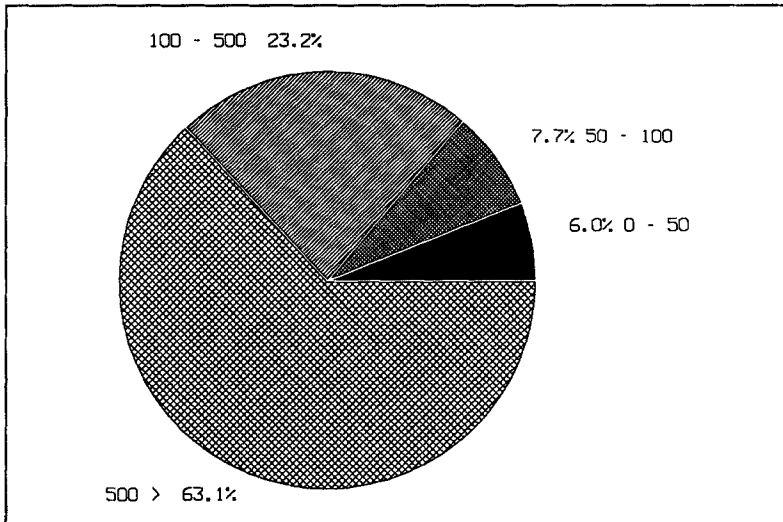


Figure 2 Number of people in the organization

4. Selection of CASE-tools

The working group was interested to discover: (1) the major reason for purchase, (2) the type of information used in decision-making, (3) the kind of test performed, and (4) the major selection criteria.

4.1. Major reason for purchase

In the literature, the word "CASE-tool" tends to be associated with productivity improvement. CASE-technology is said to be the certain way of decreasing the "application backlog" through improved productivity (McClure, 1989). Dutch users emphasize the importance of another tool characteristic: quality improvement is the most important reason for purchase.

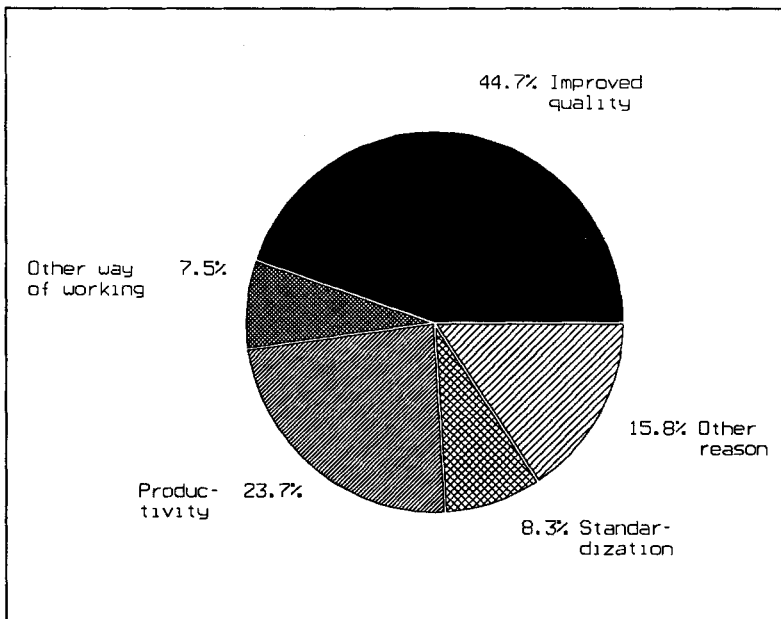


Figure 3 Major reason for purchase

4.2. Information sources

The most important information source in the selection process is a demonstration of the CASE-tool, preferably conducted on site by their own employees.

4.3. Number of CASE-tools compared

It was surprising that more than 23% of the respondents stated that only one tool was considered in the selection process. Less than 17% of the users had compared three other CASE-tools before buying.

4.4. Tests performed

In more than 75% of the situations the CASE-tool was tested at the own site before final purchase took place. In half of these this test took the form of a pilot-project, while also in a considerable number of situations the test was performed by a staff department responsible for methods and techniques. The test was usually short: nearly 80% of the tests were completed within three months.

4.5. Selection criteria

Which selection criteria influenced the final choice most? The most important criterion was the capability of the tool for consistency checking, followed by growth potential of the CASE-tool and continuity of the supplier. This indicates that CASE-tools are not considered to be perfect yet. User friendliness, quality of diagrams, integration by central data dictionary, support of the supplier, hardware requirements and correctness of techniques and methods supported are also important criteria.

It is interesting to note that interfacing capabilities with DBMS's on target machines or code-generators and multi-user possibilities come very low on the list of criteria.

5. Implementation in organizations

Once an organization has decided to buy a specific brand of CASE-tool, it has to be implemented in its information systems department. The following aspects are thought to be important in the course of this implementation process: (1) standardization of CASE-tools and techniques, (2) procedures to achieve a correct use of CASE-tools and (3) training of CASE-tool users.

5.1. Standardization

An indication of how definitively an organization has chosen to use a certain CASE-tool is the fact that it makes the tool an official company standard. Slightly more than half (51.9%) of the organizations had taken this step.

This figure is similar to the response to the question on how many CASE-tools the organization owns. Over 40% of the organizations have more than one brand of CASE-tool.

If the answer to the question on standardization is related to that on the length of experience with the CASE-tool, that the longer a tool is owned, the more frequently it becomes a standard. In 61.2% of the situations, organizations with more than one year of practical experience have made their CASE-tool standard.

It is always a point of discussion whether the technique or the tool is chosen first. In this survey we asked whether or not the tool supported the techniques that were standard at the moment the tool was purchased. In 64.2% of the organizations the CASE-tool supported the standard techniques. The other 35.8% of organizations apparently used other or no techniques prior to the purchase of the CASE-tool. It is to be expected that the implementation of a CASE-tool in such a situation, causes considerably more problems than implementation in an IS department that already has practical experience in the use of the techniques supported by the tool.

5.2. Procedures

The introduction of a CASE-tool in an organization in 43.8% of cases lead directly to the establishment of formal procedures to standardize the way the tool is used. Main points in these procedures are: drawing conventions, naming conventions and producing standard reports. A significant number (45%) of the organizations which did not establish procedures immediately, say that they plan to do so.

5.3. Training

Becoming acquainted with a new tool is usually achieved by self-study. In most cases the regular manual is used for this purpose, but sometimes a tutorial is used. Only a relatively small number of users attend training sessions.

In addition, it must be said that the response differs significantly between the various CASE-tools: for SDW-users self-study is more than four times as important as training by the supplier, for IEW-users both possibilities are equally important. Excelerator-users have a very high score for the use of the tutorial and in-house training.

These figures probably vary in different countries because of the influence of the marketing strategies of the dealers. On the other hand it is likely that there is a real relationship between the praise of SDW-users for the user-friendliness of the tool and the fact that they feel confident enough to learn to use the tool themselves.

Most users (36%) do not make an explicit planning for the time they need to master the tool. When they plan, they select a very optimistic period of one week. The

differences between brands are considerable: the expectations of SDW- and Excelerator-users are in line with the overall answer, while most IEW users plan a month to get familiarized with the CASE-tool. These users also very often attend training courses.

6. Practical experiences with the use of CASE-tools

The major part of the questionnaire dealt with the practical experience in the day-to-day use of CASE-tools. The following questions were asked: how long has the CASE-tool been used, how does the organization use it, and how satisfied is the organization with various aspects of the tool?

6.1. Length of experience

The answers show that the use of CASE-tools is still relatively new in the Netherlands. More than 57 % of the organizations have used their current tool for less than one year. Not more than 11.4% has worked with the tool for more than two years. For this question there is an important difference between the various tools. The Excelerator-users have the longest experience, followed by the IEW-users. The shortest period of experience is found in the SDW-users; 50% of whom have used the tool for six months or less. These figures are in line with the time these different brands have been on the Dutch market.

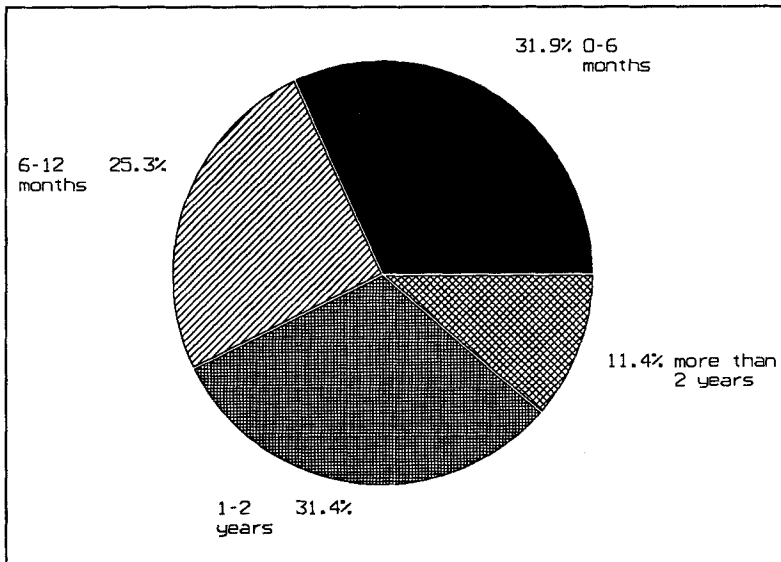


Figure 4. Length of experience

6.2. Consequences for the way of working in I.S. development

It is interesting to discover whether the introduction of CASE-tools in Information Systems Departments leads to a change in the way that software developers design and build systems.

The respondents were asked to indicate how their work had changed as a consequence of the use of CASE-tools. This introduces a difficulty in the interpretation of the results: it is of great importance to know the situation in the IS department before the tools were introduced. In general it can be said that the use of information system methodologies and structured techniques is quite common in the Netherlands. It is important to realize this while interpreting the following information.

6.2.1. Iteration

James Martin (1988) claimed that "the classical single-iteration 'waterfall' life-cycle does not work in many situations". In his view, development should be a multi-iteration or evolutionary process. The use of "design tools" will facilitate easy modification of the design. On the question whether tool use has resulted in more iteration in the design process: 56% of the respondents answer that this is the case. However almost 37% indicate that iteration does not change.

In a closely related question we asked whether prototyping was employed more often after the introduction of CASE-tools. This suggestion was clearly rejected: 80% of the respondents answer that tool use does not lead to prototyping.

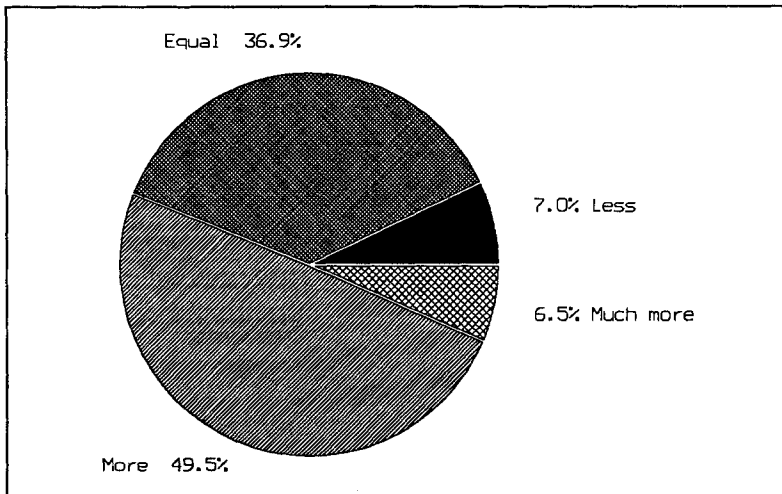


Figure 5 Iteration in development process

6.2.2. Duration of a project

As stated earlier, CASE-tools are often promoted as the ultimate solution for the "development backlog" or "software crisis". McClure (1989) reported "dramatic" increases in software productivity as a result of computer-aided software engineering.

In order to avoid confronting the issue of "productivity" directly, the questionnaire asked respondents to indicate what the duration of a project utilizing CASE-tools was as a percentage of that duration when CASE-tools were not used. 100% would mean "just as long as before", 50% would mean "half of the time". It appears that the most frequent answer to this question is 100% and the average answer is 95% ! No matter what definition one uses for "productivity", these figures do not support the idea that the available CASE-tools solve the software crisis.

6.2.3. Standardization

A great majority of respondents (88%) indicate that the use of CASE-tools leads to more standardization.

6.2.4. End user participation

In paragraph 6.2.1 we saw that the use of prototyping was not growing as a result of tool use. Does this mean that there is no change in the way the professional software developer communicates with the end-users of the system? A considerable number of respondents (40.7%) state that the participation of end-users has increased and that the users have become more active. However 58.4% answer that the role of the end-users has not changed as a result of CASE-technology.

Because of characteristics of CASE-tools like, the power in graphical representation, its ease of change and the possibility to present screen and report designs in a easy way, one expects that participation of end-users in the design process would really grow. The outcome of the survey however supports our final conclusion that today the way system developers work is not strongly influenced by CASE-tools. Or to put it more clearly: it seems that CASE-tools are used in an old-fashioned way.

6.3. The support offered by a tool

Several questions were asked to discover how tools were being used.

6.3.1. Development stages supported

As expected, tools are mainly used for analysis and design. IEW is used considerably more often during information planning than the overall average, but is not used

during maintenance. SDW and Excelerator are quite often utilized during the latter phase. If the average period of experience is taken into account, it is likely that use during maintenance is mainly concerned with providing documentation for existing systems.

6.3.2. Techniques supported

In the questionnaire respondents were asked to indicate which techniques they used, with or without the support of the tool. The answers clearly show that dataflow and entity-relation diagrams are the most popular structured techniques among Dutch tool-users (more than 80% of the respondents used them). Matrices and decision tables are important techniques which are often not supported by tools. In the set of programming techniques, the Nassi-Shneiderman diagrams are considered to be the most popular (although often not supported by a tool). It is followed by Jackson diagrams, while the relatively modern "action diagrams" are hardly used among Dutch tool-users. Decomposition diagrams are also very popular with IEW-users (81% of them use this technique). Excelerator-users often use Structure Charts (60%).

6.3.3. Interfaces with other tools

Currently there is no tool which really supports the complete life-cycle of an information system. This means that automation of software development can only be achieved using several tools which use each others results.

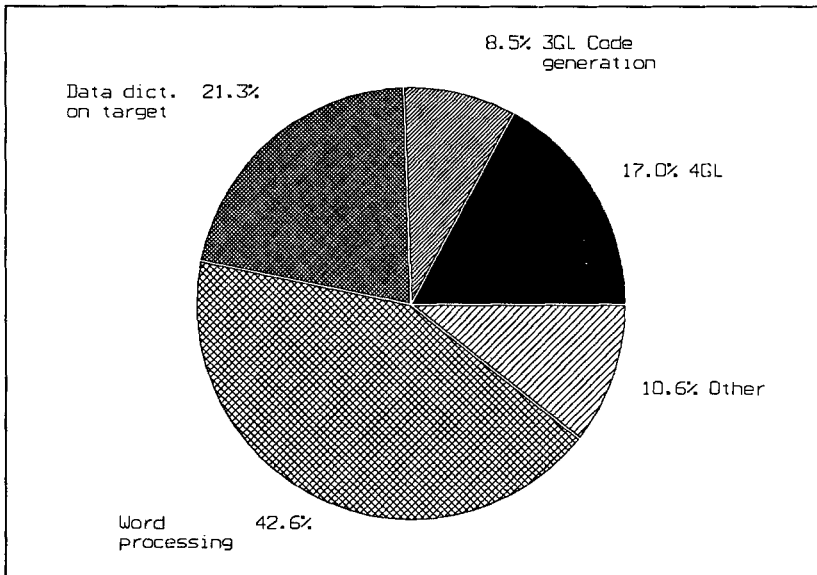


Figure 6 Interfaces

However this is hardly done in the Netherlands with the exception of wordprocessing interfaces. The majority of users do not have any interface with other tools. Apart from interfaces with word processing programs (merely a sign of weakness of the editors in the present CASE-tools): 20 respondents had realized an interface with the data-dictionary of a target-machine, 16 interfaced with a fourth generation language and 8 with a third generation language code-generator. Without doubt it can be said that, in the Netherlands, CASE-tools are currently used stand-alone.

6.4. Evaluation of CASE-tool characteristics

Respondents were asked to evaluate their tool by giving it a mark for several of its aspects. They were offered a range of 1 to 10 (the usual way of evaluating performance at school in the Netherlands): "1" meaning very poor, "10" meaning excellent.

Table 1 below shows the overall averages for all tools, together with individual scores for SDW, Excelerator and IEW. The average for all tools is weighted: for each brand an average was calculated, the averages were summed and divided by the number of brands. A brand was excluded from the calculation when its average showed a standard deviation that was too large. To give an example: the average of the aspect "price" is based on 11 brands, excluding the tools Promod, Software Through Pictures and Teamwork.

The most highly appreciated aspects of current tools are:

1. quality of diagrams
2. correctness with regard to applied methods and techniques
2. expectation of continued support from supplier
4. consistency checks
5. user friendliness
6. time to master tool
6. growth potential of the tool

Users are dissatisfied with the poor interfaces with all other software products, the lack of support for multi-user environments and the limited possibilities to adapt the tool to own standards.

Poor marks are also given for factors which could easily be avoided given the current state of know-how: text-editors and possibilities to make your own customized reports based on the data-dictionary of the tool, are insufficiently supported. The price of the tools is in general considered to be too high.

CRITERIA BY SUBJECT	AVE-RAGE	EXCEL	IEW	SDW
		52	26	99
METHODS AND TECHNIQUES SUPPORTED				
Correctness methods and techniques	7.3	6.8	7.6	7.1
Consistency checks	7.2	6.1	7.9	7.0
Central data dictionary	6.7	6.0	7.0	6.8
Adaptability tool	5.0	5.1	3.9	5.4
SUPPLIER				
Received support	6.7	7.4	7.3	6.8
Continued support	7.3	7.8	8.1	7.9
Price	5.7	6.3	5.2	6.3
Growth potential tool	7.0	7.0	7.9	7.7
Number of new releases	6.0	5.9	5.8	5.4
EDITORS				
Time to master tool	7.0	6.5	6.6	7.8
User friendliness	7.1	7.6	7.1	8.0
User manual	6.3	7.1	6.8	6.1
Quality text-editor	5.6	4.6	4.9	5.6
OUTPUT QUALITY				
Quality of diagrams	7.4	7.2	7.5	7.6
Standard reports	6.1	7.0	6.0	6.2
Customized reports	5.1	6.2	3.8	5.0
TECHNICAL ASPECTS				
Hardware requirements	6.9	7.4	6.0	7.9
Reliability	6.9	7.5	6.8	7.0
Response-time	6.7	6.8	5.9	6.8
INTERFACES				
Interface to code-generator	5.0	4.1	5.0	4.2
Interface to DBMS	4.7	3.8	5.3	4.0
Interface to other software	4.0	4.7	5.0	3.8
MULTI-USER				
Multi-user possibilities	5.8	4.5	3.6	3.8
TOTAL RATING				
Overall qualification	6.8	6.6	7.1	7.1

Table 1 Marks of CASE-tool characteristics

When we compare the scores for Excelerator, IEW and SDW with the overall average scores, the following can be observed:

tool	better than average	less than average
Excelerator	received support user manual standard reports customized reports	consistency checks central data-dictionary price quality text-editor interface code-generator interface DBMS interface other software multi-user possibilities
IEW	consistency checks continued support growth potential of tool interface other software	adaptability tool quality text-editor customized reports hardware requirements response-time multi-user possibilities
SDW	growth potential tool time to master tool user friendliness hardware requirements	interface code-generator interface DBMS multi-user possibilities

Table 2 Comparison between Excelerator, IEW and SDW

The respondents were also asked to give an overall mark for the tool. It must be emphasized that this mark has to be interpreted as the overall general feeling about a tool expressed in one mark. The average over all tools was 6.8 meaning "reasonably good". For the most important tools these scores were slightly higher (7.1) for SDW and IEW, and slightly lower (6.6) for Excelerator.

7. Expectations for the future

Finally the respondents were asked their future plans for CASE-tools: 51% of them expected to increase use of their current tool; 17% plan to use more tools of different brands in the future; less than 10% plan to switch to another tool; 22% of respondents intend to stabilize at their current level of usage.

The open questions at the end of the questionnaire were provided in order to give an opportunity to comment freely on the future directions of tools (or on the questionnaire itself). The remarks made seem to be a reflection of the hot items in publications on software development: full life-cycle support, integration of tools, reverse engineering and better interfaces with the DBMS's on target machines. Another popular answer was the need for multi-user tools.

8. Conclusions

In general we can say that CASE-tool users are moderately positive about the CASE-tools which they use. The average overall qualification for CASE-tools is "reasonably good". The most highly appreciated aspects of current tools are quality of diagrams, correctness and consistency with regard to applied methods and techniques, user friendliness and future potentials. Users are dissatisfied with the poor interfaces with other software products, the lack of support for multi-user environments and the limited possibilities to adapt the tool to own standards.

The main reason for purchasing tools, is to achieve quality improvement. The most important criteria in selecting a tool are consistency checks, growth potential of the CASE-tool, reliability of the supplier and correctness with regard to applied methods and techniques. Other important criteria include ease of use, quality of the diagrams and integration into one central data-dictionary. Interfaces with 4th generation languages and code-generators were not considered to be as important as some suppliers would possibly like them to be. Another aspect that was surprisingly unimportant in the selection process was multi-user possibilities. The appreciation of these aspects in current CASE-tools is low, while in their future plans users mention a growing importance of these aspects. This seems to indicate that these criteria only become of more importance in the selection process when the primary criteria are handled in a satisfactory way.

Quality improvement of information systems can be reached best in the early phases of the development process. Tools that support these phases are more likely to contribute to quality. In our inquiry CASE-tool users mentioned quality improvement, standardization and consistency as very important issues. This agrees with the authors opinion that CASE-tools should in particular address the first phases of the development process.

From the length of experience and from the way tools are used, we have concluded that CASE-tool users in the Netherlands have just made a start with CASE-tools. However, if we look at the expectations for the future, we see ambitious plans such as: code-generation, multi-user environments, interfaces, reverse-engineering, entire life-cycle support, etc. We are not sure whether these ideas are based on the general presentations of CASE-tool suppliers, articles in the press or on realistic needs. When we see how CASE-tools are used today it is definitely necessary to pay more attention and put more effort to the adaptation of system development methodologies and project-management techniques to the use of (current) CASE-tools and vice versa. This is more important than quickly following all new CASE-technology enhancements.

Based on the results of this survey, we have come to the conclusion that CASE-tools are only slowly and very cautiously introduced into the organizations. The view on CASE-technology seems to be: make use of it, but do not completely depend on it.

Note

The NGGO working group that published the results of the survey in september 1989 consisted of 8 members employed by universities, consulting firms, government and industry. The chairman, and co-author of this paper was at the time employed by Cap Gemini Nederland BV. On January 1, 1990 this company merged with "Pandata", a Dutch softwarehouse and manufacturer of the CASE-tool SDW, into a new company called Cap Gemini Pandata.

References

- Hatley, D.J. and I.A. Pirbhai, Strategies for real-time system specification, Dorset House, New York, N.Y., 1987
- Martin, J., Documentation for the James Martin Seminar, 6th edition, 9th series, Savant Institute, Carnforth, Lancashire, 1988
- McClure, C.L., CASE is software automation, Prentice Hall, Englewood Cliffs, N.J., 1989
- NGGO, Computer ondersteuning van gestructureerde ontwikkelingsmethoden. een inventarisatie van tools, NGGO, Amsterdam, 1988
- NGGO, Ervaringen met tools, NGGO, Amsterdam, 1989
- Ward, P.T. and S.J. Mellor, Structured Development for real-time systems, vol.1. & vol.2. Prentice Hall, Englewood Cliffs, N.J., 1986
- Yourdon, E., Modern Structured Analysis, Prentice Hall, Englewood Cliffs, N.J., 1989