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Success and Failure in CASE Tools Adoption: A Tale of Two Organisations

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This paper describes experiences of two prominent Malaysian organisations in introducing a particular product of Computer-Aided Software Engineering (CASE) tool within their MIS departments. One organisation was able to introduce the CASE tool successfully. In contrast, the same CASE product was abandoned and became 'shelfware' in another organisation. A comparative illustration of the organisational circumstances is presented and the conditions that contributed to the success of the tool in one organisation and failure in another are focused. Furthermore, the approach adopted by these two organisations in introducing CASE tools is critically examined. The lessons learned are highlighted.

1 Introduction

Computer-Aided Software Engineering (CASE) tools have occupied a position of prominence in the current literature (Blanc and Korn, 1994). These tools have emerged to support automation of software development process (King and Galliers, 1994). Such automation is a revolutionary progress in software industry that aims to alleviate many of the problems associated with systems development and maintenance tasks (Laplante, 1991). Several studies (Stobart et al., 1991, Kusters, 1993) report that the use of CASE is growing, but not at a dramatic rate as anticipated. In fact, many organisations have experienced difficulties in implementing CASE tools (Summer and Ryan, 1994). One reason is that organisations often ignore the importance of a systematic approach in introducing CASE tools within their MIS departments. As a result, even many powerful CASE tools became 'shelfware' (Rahim et al., 1994). This has been confirmed in a pioneer survey on the use of CASE tools among Malaysian organisations that found that around one-third of the surveyed organisations experienced CASE failure (Selamat et al., 1994). An interesting observation was that a particular CASE tool was found to be successful in an organisation that experienced an improvement in quality and productivity. On the other hand, the same CASE tool that was acquired by another organisation, failed to achieve its purpose. The authors realised that it is important to investigate specific instances of successful CASE adoption as well as CASE failure, because actual case studies documenting the benefits and difficulties in the application of CASE tools are uncommon (Stobart et al., 1991). Furthermore, instances of CASE failure are rarely reported (Norman et al., 1989; Rahim et al., 1994). This paper analyses the conditions that might contribute to the success of the tool in one organisation and failure in another. Furthermore, the approaches adopted by these two organisations to introduce CASE tools are critically examined and their differences are cited. The lessons learned from their experiences are also highlighted.

2 Selected Organisations

This section presents experiences of two organisations, one a large shipping enterprise, and another a leading market research company in Malaysia. These two organisations acquired Picture Oriented Software Engineering (POSE), a CASE product from Computer Systems Advisors (CSA), in an attempt to automate their system development tasks. POSE is a PC-based upper CASE tool that operates on DOS environment. This tool provides automation support for structured methods based on Yourdon and Gane-Sarson principles. The Management Information Systems (MIS) department of the shipping enterprise adopted the POSE tool successfully, and used it effectively to develop several applications. On the other hand, the market research company applied the same tool in a small project and found it unsuitable and thus abandoned it.

2.1 Case Study 1: A Shipping Enterprise

A large Malaysian shipping enterprise made a successful effort to introduce a CASE tool into their MIS department. This enterprise maintains a fleet of cargo and passenger ships that regularly travel from several ports of Malaysia to various destinations across the continents. The MIS department of the company was formed in 1983 and is primarily responsible to develop and maintain application software in supporting shipping related activities of the enterprise.
The department further develops accounting and payroll system for the organisation. The department is headed by an MIS manager who had a post graduate degree in Information Technology and was involved in the management and supervision of MIS activities over one and half decade. A set of questionnaire was sent to the manager. The questionnaire attempted to capture the implementation aspects of CASE tool and its impact on productivity and quality. A follow-up discussion with the manager was held based on the questionnaire.

More than fifty IS personnel including programmers, system analysts and database administrators were employed in the MIS department. The operations of the MIS department were implemented using UNIX operating system running on a mini-computer. A mixture of traditional systems development life cycle and some variants of structured methods were used by the IS personnel. Majority of the software applications were developed using INFORMIX-4GL. In addition, C language and dBASEIV database management system were often used.

2.1.1 Purchase of CASE Tool: Cited Reasons

In early 1990, Picture Oriented Software Engineering (POSE), an upper CASE tool was acquired by this enterprise, with an aim to automate their system analysis and design activities. The secondary objective was to introduce a standard in the development practice across the MIS department. Another purpose was to improve the quality of their application software. It was reported that the MIS department was attracted by a leading CASE vendor who advocated that enormous benefits could be achieved through CASE tool. Furthermore, the product was inexpensive at that time.

2.1.2 CASE Implementation: Actions Adopted

A committee was formed that included the MIS manager himself, several system analysts and users. The committee adopted a number of guidelines to implement CASE tool smoothly. They realised that the introduction of a new technology like CASE may incur resistance from developers. As such, the committee arranged a workshop on CASE, in collaboration with the prospective vendor. The vendor sent sales personnel to the workshop and a half-day talk was held at the premise of the shipping enterprise. The talk was followed by a demonstration of the POSE tool.

The selection committee further identified that their developers would require a good skill in structured method prior to adopting CASE tool. As such, they chose a group consisting of twelve developers who were familiar with structured methods and had working experience with such methods. Later, they were sent for 2 weeks in-depth training on POSE. The POSE tool was implemented in two phases. The first phase included selection of system analysts who were familiar with Yourdon method and who received training on POSE. The second step was to identify a small scale pilot project. Several analysts who received training on POSE tool were involved in the pilot project. This team was given extra support and their performance was closely monitored. The CASE committee further engaged end-users during the various phases of the pilot project except in the coding stage.

The introduction of POSE tool triggered a new job title labeled as 'CASE Administrator'. It even influenced organisation's policy to recruit new IS personnel in this direction. The MIS manager indicated that in future preference would be given to those applicants having experience with CASE tools, but not necessarily with POSE tool. He further explained that even though resistance to use CASE tool was encountered by certain IS developers due to a change in work pattern, the training helped to overcome such resistance.

2.1.3 CASE Tool: Current Status

The MIS department successfully built six new application softwares using POSE tool, and two additional applications were in progress.

2.1.4 CASE Impact on Productivity

For the purpose of this study, the terms productivity and quality were left undefined so that the respondents' perceptions would be based on his own definition. Similar approach was adopted by Norman and Nunamaker (1989) while investigating CASE productivity perceptions of software engineers. The MIS manager were asked to indicate the extent to which productivity of the developers was affected due to the use of POSE tool. The perception was measured on a rating scale that varied from 0 to 3, where 0 means no effect, 1 means slight effect, 2 means moderate effect, while 3 implies significant effect on productivity. The responses of the manager were compiled which indicate that a higher productivity was
achieved in all the six CASE built applications. However, the degree of productivity improvement varied across the different stages of the development life cycle. This is shown in Figure 1.

2.1.5 CASE Impact on Quality

A moderate level of quality improvement was experienced in all CASE assisted applications. In order to determine the extent of quality improvement

![Impact on productivity chart]

**Figure 1 : Impact on productivity**

It can be observed that relatively high productivity was perceived in the upper and middle stages of the life-cycle as compared to the coding stage. The reason is that POSE is an upper CASE tool that does not generate any source code. Programmers are still required to code manually based on the automated analysis and design specifications. As a result, productivity gain was perceived to a lesser extent during the coding stage.

and how it was achieved through the use of CASE tools, the MIS manager was asked to make additional evaluations in terms of the following factors:

(a) communication improvement between developers
(b) communication between developers and end users
(c) documentation support
(d) project standards

The results of the evaluations made by the MIS manager are shown in Table 1.
<table>
<thead>
<tr>
<th>Factors affected by CASE</th>
<th>Rating Scale</th>
<th>Significant</th>
<th>Moderate</th>
<th>Slight</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved communication between end-users and developers</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved communication among developers</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved documentation</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved project standards</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: The impact of POSE tool on quality factors

It was indicated that the communication between developers and end-users as well as among the developers themselves, improved considerably through the use of POSE tool. Improved communication resulted as the developers quickly implemented user requirements into working prototypes. Moreover, end-users were able to directly interact with such prototypes in a live environment. The users perceived how quickly their views and needs were incorporated through POSE tool. This helped in building increased understanding between developers and users. Such improved communication, in turn, enhanced quality of the delivered system.

The MIS manager further indicated that the POSE documentation features freed their analysts from performing the tedious process of documentation, and thus allowed the analysts to concentrate more on the design process. The tool identified errors, inconsistencies and ambiguities that were difficult to detect manually. Furthermore, the tool kept documentation up-to-date whenever a change was made in analysis or design.

It was reported that the developers adopted the same notations and techniques across all the CASE assisted projects. This helped in establishing a standard in software development practice of the MIS department. As a result, project standards raised significantly.

2.1.6 Difficulties

Several difficulties were encountered by the shipping enterprise while implementing POSE tool. The MIS manager faced difficulties in choosing a suitable person as a CASE administrator. One of those twelve systems analysts who attended 2 weeks short training on POSE tool was eventually selected as a CASE administrator. Interestingly, this CASE administrator was not the senior most systems analyst. The manager chose a systems analyst who had a postgraduate degree and had a good academic understanding about CASE technology.

The MIS manager anticipated difficulties in obtaining fund to organise training on POSE tools for the twelve system analysts. As such, he advised the prospective supplier of the POSE tool to include the training expenses within the price of the POSE tool.

Another noteworthy problem was the selection of systems analysts out of fifty IS personnel to undertake 2 weeks training on POSE tool. The criteria that was adopted were the familiarity and working experience with the structured approach. Problems arose when some IS personnel lacking experience in structured method also indicated their willingness to participate in the 2 weeks POSE training programme. Since these IS personnel could not participate in the training, they became very upset, and their personal association with the MIS manager deteriorated. However, this problem was tackled by the CASE administrator who later personally offered in-house training on POSE tool to these IS personnel. In addition, these trained IS personnel were also engaged in building applications through POSE.
2.2 Case Study II: A Market Research Company

A leading market research company made an unsuccessful attempt to introduce a CASE tool within their MIS department. This company was founded in 1964 and subsequently pioneered the development of market research services in Malaysia. The company consists of nine departments supporting its various research activities. More than 300 full-time personnel were employed in this company. The MIS department of the company was formed in 1988. Its main function is to develop and maintain application software in supporting the research activities of the company. A set of questionnaire was sent to the MIS manager who had a bachelor degree in Computer Science and possessed 7 years working experience. The manager was also interviewed subsequently.

The operations of the MIS department were supported by a local area network that included 30 workstations of various makes and models. The file server was a 486-DX2 workstation with a 2 GB hard disk. Thirty personnel, with 4 systems analysts, 6 analysts programmers, and 15 programmers were employed in the MIS department. The IS personnel were engaged to develop various applications covering accounting software, data tabulating, market research systems, and reporting facilities. Turbo Pascal and Fortran 77 were used in system implementation. In addition, Paradox database management system was frequently used by the developers.

The MIS department did not adopt any standard method for performing systems analysis and design, and individual analysts were allowed to practise their own methods. However, the department in general adopted a top-down approach for writing source code. Occasionally, object-oriented programming was used.

2.2.1 Purchase of CASE Tool: Cited Reasons

In December 1989, Picture Oriented Software Engineering (POSE), an upper CASE tool was acquired by this company to automate their system analysis and design tasks. It was reported that the MIS department was attracted by the benefits and productivity gains as advocated by a CASE vendor. Furthermore, the respondent came to know that some other organisations were planning to acquire POSE tool. This news hastened their decision to procure POSE tool.

2.2.2 CASE Implementation: Actions Adopted

A selection committee comprising 2 system analysts and an MIS manager was formed to select a suitable CASE tool for the company. The respondent was one of the members of the committee. A short briefing was provided by the vendor before the POSE tool was acquired. Surprisingly, the respondent reported that the vendor did not offer any training before or after the purchase of the tool. The functions and features of the POSE tool were learned by the developers themselves. A small scale pilot project was undertaken. The respondent was the only participant in the development of the pilot project which took a year to complete. The respondent was required to report his experience with the POSE tool to the management. Unfortunately, the results of his evaluation was not encouraging. The respondent complained that the tool was time-consuming. Savings in terms of time and efforts were not perceived. Instead, it was felt that there was actually an increase in development time. As such, the MIS manager recommended for not using the POSE tool.

2.2.3 Non-use of CASE Tools: Reported Reasons

The prime cause of dissatisfaction with the POSE tool was that it required excessive efforts to learn. The respondent felt that the automated development process was extremely tedious to be successfully implemented into the MIS department. Other complaints included: inadequate vendor support, and lack of multi-user facilities. The inability of the CASE tool to operate on a LAN environment was regarded as a major weakness, especially since the MIS department was using a local area network.

3 Discussions

The principal features of the MIS environments of the two organisations are summarised in Table 2. It can be observed that even though CASE is still evolving, these two organisations attempted to adopt them at the beginning stage of CASE technology. This implies that MIS professionals of these organisations were aware of the development of new technologies in software industry and did not hesitate to adopt them.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Enterprise</th>
<th>Shipping Enterprise</th>
<th>Market Research Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of establishment of MIS department</td>
<td>1983</td>
<td>1988</td>
<td></td>
</tr>
<tr>
<td>Number of IS personnel</td>
<td>More than 50</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Hardware platform</td>
<td>Mini-Computer</td>
<td>IBM PC compatible</td>
<td></td>
</tr>
<tr>
<td>Operating System</td>
<td>Unix</td>
<td>DOS</td>
<td></td>
</tr>
<tr>
<td>4GLs</td>
<td>INFORMIX-4GL, dBASE IV</td>
<td>Paradox</td>
<td></td>
</tr>
<tr>
<td>3GLs</td>
<td>C</td>
<td>Turbo PASCAL, Fortran 77</td>
<td></td>
</tr>
<tr>
<td>System development approach</td>
<td>Structured Methods and SDLC</td>
<td>No method</td>
<td></td>
</tr>
<tr>
<td>Year of procurement of POSE</td>
<td>1990</td>
<td>1989</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Features of the MIS environment in the two organisations

The key reasons that prompted these two organisations to acquire POSE tool are listed in Table-3. It is obvious that the primary goal was to automate the analysis and design stages of their system development tasks. The organisations were not eager to automate the coding stage. It is because they did not consider code generation as a serious problem. It is important to highlight that these two organisations were keen to introduce a discipline in the early stages of the system development process, which was often ignored by their developers.

However, the secondary reasons that led them to acquire POSE tool requires attention. The market research company reported that they were prompted to acquire POSE tool by knowing that other organisations were planning to acquire them. This can be regarded as a ‘fashion approach’ (Mazzucchelli, 1992), which implies that the market research company did not examine their actual needs for acquiring CASE tools. The adoption of CASE tools by others prompted them to acquire it even if they did not know how they would use them.

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Type of Enterprise</th>
<th>Shipping Enterprise</th>
<th>Market Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>To automate analysis and design stages of the system development tasks</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Vendor advocated high productivity</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>POSE tool was inexpensive</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Other organisations are acquiring POSE tool</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Reasons for POSE acquisition
The actions undertaken by these two organisations to introduce POSE tool are presented in Table 4. A close look at this table reveals that the shipping enterprise formed a selection committee and formulated an implementation plan to introduce CASE tool. They managed to obtain necessary organisational resources to implement such plan. On the contrary, the market research company did not devise any such plan, even though a committee was formed to choose a suitable CASE tool.

The MIS department of the shipping enterprise standardised a structured method based upon Yourdon notation and chose a group of developers who had expertise and prior experience with that method. Only these selected IS members were sent for 2 weeks training on POSE tool.

While, the market research company did not pressure of this developer could have been lessened by providing him appropriate training. Unfortunately, training received little attention by the market research company. It is argued that the transition to CASE should be regarded as a serious move (Gibson, 1989) and as such, this developer should have been 'retooled' by providing him extensive training and coaching. Actually, CASE imposes an engineering like discipline on the development of software systems. Thus, training must focus on the CASE method as well as on the tool itself. Otherwise, the full benefits of CASE tool could not be achieved (Burkhard, 1989; Laplante, 1991).

The training of the 12 developers of the shipping enterprise on POSE tool was conducted by a CASE consultant at the vendor’s office. It was indicated that the developers cultivated required skills in applying standardise their way of developing systems and chose only one IS personnel to learn POSE tool. Unfortunately, he was not very familiar with the structured methods that are supported by the POSE tool.

As a result, the developer had to spend time to learn both the structured method as well as the mechanics of the tool at the same time. This placed an additional burden on this developer. He experienced too much learning pressure and a clash between his learning goal and productivity goal. The learning

<table>
<thead>
<tr>
<th>Actions</th>
<th>Type of Enterprise</th>
<th>Shipping Enterprise</th>
<th>Market Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation of an implementation plan</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Formation of selection committee</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Briefing or seminar before acquiring POSE tool</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Selection of a group of developers for training on POSE tool</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Use of pilot project</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Training before acquiring CASE</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Training after acquiring CASE</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Employment of consultant</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Actions adopted to introduce CASE within organisations

POSE to perform systems analysis and design based on the Yourdon method. The selection committee managed to obtain required financial resources for training as a part of the POSE tool purchase. On the other hand, the IS person in the market research company did not receive any training. The reason was that the company was not willing to spend on CASE; which was quite expensive. Management thought that the POSE tool alone would be sufficient to improve their development practice, and ignored the
importance of training. This establishes the lack of awareness and commitment of the management.

Moreover, these two organisations did not engage any consultant. It is argued that the engagement of CASE consultant is necessary. It is particularly helpful, when the developers are not well trained in the use of the CASE tools. The consultants are able to demonstrate how to apply CASE tools in building actual systems, thereby reducing the 'learning curve'. Their involvement further brings confidence among developers about the automation and significantly facilitates CASE adoption. Unfortunately, the employment of consultants seemed not to be appealing to both organisations. The shipping enterprise trained their IS people through CASE consultant and thus, decided not to engage any consultant in their application development; while the market research company was reluctant to invest for consultant engagement.

4 Lessons Learned

Several lessons can be learned from the experiences of these two organisations. First, a new technology like CASE should be introduced based on a sound plan. Such a plan should be approved by the management of the organisation. However, mere approval is not enough, because adoption of CASE requires substantial commitment from all levels of management and MIS personnel. Management should not look upon CASE tool as a solution to their software problems, rather they should also concentrate on the people issues associated with CASE implementation. For instance, adequate training to the development staff must be provided. Neglecting the need of training will rarely make CASE a success. Furthermore, the engagement of skilled CASE consultants can significantly reduce the notorious 'learning curve' associated with CASE.

Another important lesson is that the MIS department should establish a standard software development method before selecting a suitable CASE tool, and the selected CASE tool should automate the chosen method. Thus, the tool alone is not a solution to the software problem of an organisation. Powerful CASE tool at the hands of the ill-prepared MIS personnel would produce negative results and would tarnish the image of software automation. These lessons can contribute meaningfully to the improvement of any organisation intending to adopt CASE technology.

5 Limitations

One weakness of this study is that the post-delivery aspects of CASE aided applications in the shipping enterprise was not examined. Therefore, further research is recommended to address the issues related to the amount of maintenance and degree of ease of maintenance in POSI built applications.

6 Conclusions

This paper has portrayed and analysed the experiences of two prominent Malaysian organisations. One implemented a CASE tool successfully; applied it to develop several applications and experienced quality and productivity improvements. On the other hand, the same CASE product that was acquired by another organisation was found unsuitable and thus, was abandoned. The causes for such failure were critically evaluated. It was found that the implementation approaches adopted by these two organisations differ considerably. It is argued that CASE tools should be implemented based on a sound plan and if managed effectively in conjunction with reliable software development process, they can contribute to the improvement of quality and productivity. Thus, it can be concluded that the effectiveness of CASE depends as much on how it is introduced as on the tool itself.

References


