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Using CASE Tools in Systems Development

Their Scope and Value

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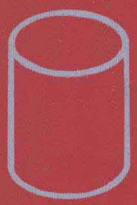

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INTRODUCTION

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What Is "CASE" And What Is Its Scope And Value?

The term "CASE" is an acronym for Computer Aided (or Assisted in some texts), Software Engineering. CASE products or tools have been introduced as a means of improving DP department efficiency and productivity. All CASE vendors and CASE users recognise the need for improving both the efficiency and productivity of data processing departments in the development, support and maintenance of computerised systems for business users. This has become a particularly important issue given the ever increasing use of data processing resources within business activities. DP people are not cheap, and are becoming the most significant overhead many businesses have to pay for. Consequently any means by which this human DP overhead can be reduced or made more efficient has been readily examined throughout the DP industry.

As with many oft quoted and used phrases CASE has the capability to be all things to all men. In terms of definitions of CASE there are almost as many as there are "CASE" products. In respect to this problem Holloway N. [1] proposed that three basic CASE categories of product were recognised. These were;

- Analyst Work-bench Products - These support the improvement of productivity in the analysis and design stages of the systems life cycle. They assist in both speeding up and clarifying business data and processing activities and needs. They support specific structured methods of analysis and can thus assist in the standardisation of the level and quality of documentation necessary to support the later phases of the development in a more effective manner. They normally include a graphics facility, representing business data items of interest, in the terms of a particular structured method that the analysts use to assist in their business data and processing definition descriptions,

- System Generators - These support the improvement of productivity in the conversion of business data and processing definitions automatically into computer activities. This produces a set of well documented and efficient programs and screens. These support an automatically generated database structure that is truly reflective of the business data relationships and contexts of importance to users.

- Life Cycle Products - These support both of the previous two aspects of CASE.

Two further types of CASE tools can also be recognised as playing a significant role in the improvement of productivity within the systems development life cycle;

- IPSE Tools - These facilities offer an Integrated Project Support Environment which can enable a system to be developed in a unified computer environment. IPSEs fall into two basic sub categories;

  Open IPSEs - Which provide a framework for each project to be able use the most suitable tools for its needs, regardless of whether they come from the IPSE supplier, another supplier, or have been produced in house.

Closed IPSEs - Which offer a package of design, project management, data handling methodologies and CASE tools that must be applied by all projects using it

- Strategic Planning Tools - Such CASE products are geared at the end user community, who require to obtain and manipulate data for planing purposes. They contain facilities which allow data to be selected and represented graphically and then passed to other packages for more detailed statistical analysis.

Currently no CASE tool fully supports all requirements of the systems development life cycle. Different tools must be integrated together as one moves from the strategic business planning and feasibility stages through to post implementation and operational business planning. The tools are still very much in their "First Generation", in terms of capabilities, although unquestioned benefits for productivity and quality within the systems development life cycle has already been gained from their use to date.

The papers presented in this publication attempt to address the whole CASE environment, as it is currently recognised within data processing in respect to systems development, from analysis to implementation. This starts by addressing the strategic and business needs that CASE is being viewed as a facility to help support. Consideration is then paid to the ways in which CASE tools have been used and what implications they can have for organisations. An assessment of where the CASE tools of the present fail to meet the perceived business and DP requirements is put forward, and a view of what the CASE tools of the future must be able to support is given. The following major aspects of CASE are covered :-

- To recognise management needs within DP in respect to CASE technology;
- To consider what criteria for CASE choice should be referenced in respect to business and data processing needs;
- To consider ways in which CASE can be used to support businesses, regardless of the business or physical requirements;
- To recommend strategies for CASE use;
- To describe at what levels CASE tools have been used to support business needs;
- To consider the potential problems, in data management terms, of CASE implementation in organisations;
- To discuss the needs of business and DP users for CASE support over the coming years;

The publication addresses these points in five sections.

Section 1. Management Considerations :

The ever increasing involvement of data processing departments in business systems support throughout the 1980's has resulted in a dramatic increase in DP resource use within organisations to support their activities. The results of this extra DP involvement has given organisations a dramatic improvement in efficiency in business processing. At the same time, however, all other organisations

have followed the same approach, ensuring that they can continue to compete. With the opening up of new markets for business, especially the concept of the global market, and more specifically in Northern Europe, the imminent arrival of 1992 more and more requirements have been placed upon DP departments to undertake in terms of further business support.

This situation has enabled large DP departments to be created, but at the same time has led to skill shortages in terms of personnel to fill them. In the 1960's and 1970's the significant DP costs were machines and software; in the 1980's these costs have been significantly reduced in terms of the power available within machines to do work, but have been replaced with an ever increasing human resource cost. The needs for ever more DP personnel to support business processing is simply impossible to meet. When one adds to this the problems of an ageing population, as is common in all western countries, other solutions to developing the DP support of businesses are necessary.

This situation is often termed "The Software Crisis", and to address this problem software tools and products have been developed to assist in the undertaking of the work of the human DP resource. Initially these tools, known as CASE products, focused upon the support of analysis activities (termed "Upper CASE"), and code generators, (known as "Lower CASE"). The early implementations of these facilities assisted in the development of computer systems significantly, but in selected ways and environments. Many tools have been launched onto the DP market, and many different products can now be purchased to assist in these tasks. The selection of which is most suited to a particular task, development or software environment has become a skilled activity in its own right, and consequently, is a matter of major DP concern.

Making the CASE tools selected work in the optimum manner possible for the business is becoming an ever increasing need. This is particularly true as the requirements for data sharing and data access become ever more common. When business users have systems implemented to support their activities it must be remembered to try and reference what their future requirements are likely to be, and where these can be met by systems flexibility. This is a major benefit of the CASE approach, which is frequently quoted by CASE vendors, and so it must be implementable. Business users and DP personnel must be aware of how such systems can be best exploited outside of the initial terms of reference of the system specification, or the statement of user requirements, and as with CASE assessment and choice, such activities are becoming major requirements of many organisations.

Section 2. CASE Use In Strategic Terms :

Many serious strategic choices for DP systems development adopting a CASE approach are available, and each has a different set of requirements that must be addressed. By adopting CASE technology it is much easier to remove the constraint of having large, centralised data processing facilities with major overheads in terms of office space and processor power. It is now possible to distribute systems development using CASE products to ensure optimisation of analyst, designer and programmer resource, as well as cater for the problems of project management and hardware availability. Many systems developments can be based upon micro computers with remote links to central dictionary facilities, enabling systems to be developed in areas where overhead costs, (notably labour and office rents), are lower. These options are very attractive, but require serious attention in terms of the management of the data that is defined.

Choices on enabling new CASE developments to work in a logically transparent manner with older systems in the eyes of the business user must also be considered. Often new CASE systems have to reference data stored and maintained using older methods of systems development. Strategic decisions on the best ways to achieve this sort of activity must be determined before any such system is implemented.

Many factors have to be addressed to ensure that the best method of using the CASE technology that

is available is implemented in any particular DP environment. Reference to data processing architectural strategies must be considered, along with the cost and time constraints placed upon the business areas that are to receive the systems support. The interface to older systems has to be transparent to the business users, and specific attitudes to this problem have to reference the individual needs of the business itself, and the organisation within which it operates. Only by producing a strategy for CASE use that considers all of the factors operating in a business environment will result in a sensible choice for the business itself.

Section 3. User Experiences - The Benefits Of CASE :

CASE usage is still concentrated in the areas of analytical support ("Upper CASE"), and code generation ("Lower CASE"). Even in these areas there are relatively few projects which have completed their systems development life cycle to a stage at which assessments of the projects can be made. Unquestioned benefits have been realised by the adoption of such products, and it is essential that these experiences be shared and learnt from. The study of such experiences enables objective assessments to be made of the claims made by the product vendors in terms of the productivity gains, improved systems accuracy, greater flexibility of business support and future CASE systems maintenance and enhancement. The papers given in this section reflect the current situation of CASE tool usage in business environments, and the lessons such experiences yield should significantly assist other organisations geared at providing systems in similar contexts.

Section 4. The Challenges Of CASE - Data Management :

By implementing a CASE strategy an organisation's DP department enters a new business environment. The approach of CASE use is geared at increasing the participation of the user in the systems development process to a level not experienced before. The outcome of this involvement should enable the senior business managers to be the logical designers of the system to be implemented, whilst the DP staff take on the role true technicians and business consultants. By the adoption of prototyping from the CASE documentation confirmation of the necessary levels of business support required can be obtained. This approach has a number of "challenges" associated with it, and if these are not recognised and planned for prior to the first CASE system becoming operational, they can have serious sub-optimising effects on the way in which the resultant system operates, and the way in which DP supports them, and is politically recognised within an organisation. Many organisations implement more than one type of CASE tool, some of which may not be in line with any recognised corporate strategy, but that support a short term objective or requirement. This situation, which is common within the larger organisations which have DP departments, requires special treatment and planning to minimise the risk of data definition incompatibility and a reduction of potential problems of data sharing across different CASE systems boundaries, and between any of the CASE systems and the non-CASE systems.

It is also important to appreciate what tools support what activities to what level of effectiveness in the business environment given the existence of such a situation. Awareness of such limitations and impacts in this context is essential.

Section 5. CASE Tools And The Future :

No individual CASE vendor or CASE user possesses a crystal ball, but many users and vendors recognise the current limitations of the existing CASE products. At the moment these limitations have to be worked within, but fundamental extra requirements have to be incorporated into the products in the future. This is particularly true of the need for logical transparency between different CASE products and their documentation, the need for common standards for dictionaries to be defined and implemented, and for the need for CASE to more effectively support true distributed systems development. The need for standards in terms of CASE production of systems documentation, that are

reflective of the outputs of structured methods is an essential requirement to support. This section references work currently being undertaken in this area as a basis for future CASE tool conformance to structured methods, in terms of their documentary output. In this way this publication links to previous published work by the Specialist Group, Holloway S. [2], and can be seen as attempting to answer some of the questions raised in that document.

Consideration of users requirements and expectations must be referenced and interfaced to the views of the vendors. This section considers both sides of the "CASE Fence" in an attempt to assess the future directions of the products, and what one can expect them to support and reference.

If one is to be able to optimise the potentials for productivity gains offered by CASE such matters must be addressed. In these ways the future for CASE can be suggested and discussed, because these requirements must become a standard part of future CASE products.

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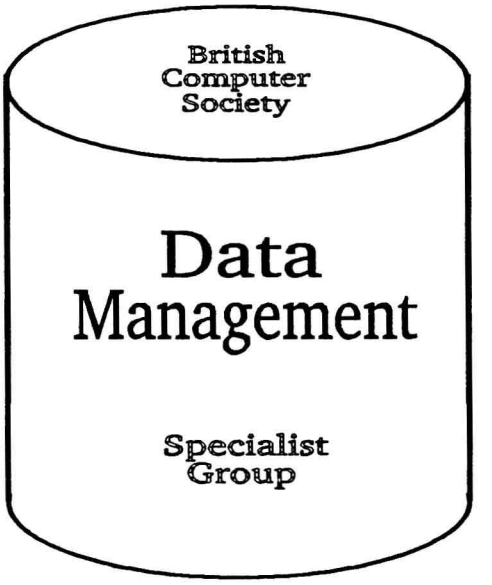
[1] HOLLOWAY, N. (1987) : "Categories Of CASE Tools", ICP Business Review, December 1987.

[2] HOLLOWAY, S. editor, (1989) : "The Future Of Data Dictionaries", Gower Technical Press.

MANAGEMENT OVERVIEW



THE BUSINESS NEED FOR CASE

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1.1 Introduction

As in most other companies, the Management Services Group in the Automobile Association is faced with some significant and changing problems providing information systems to its customers. The objective of this paper is to identify those problems, and to attempt to assess what Computer Aided Software Engineering (CASE) can do to provide the solutions now or in the future in terms of the support of business data processing.

Some of these problems have been around for many years and the industry has still not cracked them. Others are the result of changes in the environment in which we live and the opportunities created by the dramatic technology and price/performance improvements now occurring. The problem areas can be summarised under these headings:-

- the need for quicker delivery of solutions;
- the need for reduced costs of solutions;
- the need for increased flexibility of solutions;
- shortage of skilled staff/increasing workload.

One should notice that the word "solutions" appears in this list rather than "systems", "information systems" or "applications". This is deliberate and reflects the fact that solutions to modern user requirements no longer consist merely of the development of bespoke application software but are an amalgam of hardware, software, voice and data communications, packages, bespoke application software and very often require distributed functionality and data. The need to provide these hybrid system solutions means that the assistance we are seeking from the supply side of our industry is better defined as Computer Aided Business Solutions (CABS) rather than CASE which concentrates on software development only.

To address the requirements of Computer Aided Business Solutions consideration must be given to the areas of concern referenced in this chapter, and ensure that these concerns are addressed effectively.

1.2 Quicker Delivery Of Solutions

In the current competitive economic climate this is the most important user requirement. Typically in the past, large operational level information system solutions have taken up to two and a half years or more to deliver and even medium sized systems could take a year or more. Businesses can no longer tolerate such timescales which result in market opportunities being missed. End date driven projects are here to stay, and the challenge is to deliver, within the imposed timescales, a quality solution, knowing that it will be acceptable to the business areas as it demonstrably supports their defined needs. This contrasts significantly with the oft produced "quick and dirty" offerings of the past, which were always delivered with the hope that they would be "acceptable" to users, rather than categorically correct.

The answer to providing quality solutions is to "do the up-front job properly". That is to say, ensure that user requirement definition, data and functional analysis are performed to a high standard using formal methods and recorded in a corporate dictionary to form the foundations for the remainder of the development. This is a pre-requisite for the use of any productivity tools or other techniques which will shorten the remainder of the systems delivery cycle. The use of a graphics interface is essential to reduce time spent on the analysis phase, as such a facility enables analysts to more easily conceptualise the business requirements, as well as document them on a corporate data dictionary. In this way the analyst work-bench type of CASE tool can be seen as an essential element in the systems development life cycle, and one which the DP department must address.

The AA has had considerable success as a result of moving to this approach including implementation of a corporate marketing system in seven weeks, using the ICL Data Dictionary system and the Quickbuild product set, rather than the predicted four months for a traditional development. Another, much more complex publishing system was implemented in eight months rather than the estimate for a traditional development of eighteen months. Neither would have succeeded but for accurate unskimped analysis, in fact the marketing system development required six weeks analysis and only one week to build and implement.

Consequently, the first, fundamental requirement for a CASE (or CABS) product to be able to support must be the performance of complete data and functional analysis, by providing:

- an effective interactive, graphics based interface to the major data dictionary systems in corporate use;

- a correct implementation of recognised structured methodologies, which currently includes SSADM, D2S2, Yourdan/DeMarco and LSDM, supporting them fully in terms of analyst needs and understandings;

However, given that we have taken care of the quality problem, hitting the target of quicker delivery depends upon two factors. Firstly, the provision of tools to automate as far as possible the design, coding and testing of bespoke application software and secondly the provision of support for the project management function.

Tools are starting to become available which use the results of the analysis stored on dictionaries to generate code (analyse and generate tools). Although most are immature in respect to organisational needs, and their development seems to suffer from a lack of use of software engineering principles, judging from the delivery slippage so far, it is essential that any successful CABS system will have to be able to utilise such tools. Although productivity tools such as ICL's Quickbuild, and others, provide good gains in both productivity and elapsed time, they are only part of the answer.

Project Management is a key ingredient of all projects and one which in general is not well done. The hybrid projects I described earlier require even greater project planning and control skills, and without these all other productivity gains will be lost and more besides. Additionally, it is worth remembering that project management is currently estimated in average systems development contexts as a 15% overhead in manpower, but a 30% overhead in cost. Consequently we must examine what facilities are available to help us in this area particularly. Currently, the answer appears to be somewhat disappointing, a few planning tools, some stand-alone project management methodologies and very little else.

In the defined CABS system we need support for an integrated set of project management functions consisting of the following;

- A total life cycle methodology covering all aspects of business solution development, implementation and maintenance. The software development phases should be covered by the chosen structured method of the organisation, (SSADM, LSDM, etc), and the remainder could be provided by the internal business and DP functions. It is essential that the chosen method should not be prescriptive, nor should its implementation in hardware terms be restricted to that of a single vendor.

- A set of project planning standards based upon the life cycle method.

- Estimating tools covering the various methods of development. Of those projects that fail, it appears that most do so, at least in part, because of poor estimating.

- A project modelling tool with "what-if" capability.

- A project control package which collects/disseminates information from/to project members and provides information on progress against plans and costs against budgets.

- A facility, or linked set of facilities that support documentation, version and change control.

1.3 Reduced Costs Of Solutions

The set of CABS requirements previously defined will address this need also. However, it is doubtful whether the overall cost of development will reduce by the implementation of this proposed set of CABS requirements. The cost of maintenance and enhancement will be reduced because of the increased quality of the analysis and design of the solution. This is because such an approach enables maintenance to be undertaken in a fully structured and controlled manner. The changes required will reference the necessary amendments to the systems documentation already produced, and by its continued maintenance, in data definition terms, will ensure that the costs of changes can be more accurately estimated, and more easily implemented. This point and argument are often stated and used in presentations and text books, be they referring to CASE tools or structured methods,and often no real examples to justify the claim are given.

The AA is in a slightly more fortunate situation, as these principles have been embodied in the new systems developments referenced in this paper. An example of where such benefits can be obtained can be seen in the example of the marketing system described above. After its implementation the users, naturally enough, wished to extend and change some parts of it. As marketing is, by its very nature, a very dynamic, and fast changing business this situation had been anticipated in advance, and catered for in both the systems documentation and its implementation. A business user approached the support team in the earlier period after implementation, requesting new additions to screen validations and new values of data items for certain attributes and fields to be included. The normal change control procedure for such activities is between four and eight weeks. This is to schedule, cost and implement the change. However, in this case the business opportunity that existed which necessitated these changes being implemented had a limited time frame in business terms (under two weeks), if some competitive edge over other organisations operating in the business in question was to be gained. By the use of the CASE tools and the data dictionary documentation that underpins them it was possible to effect the change over the lunchtime of the day that the request was made. The system was regenerated and up and running again in the afternoon. The whole process had taken two hours to achieve in elapsed time, and the business processing use of the system had only been lost for that

amount of time. The users were, quite naturally more than a little surprised about the whole exercise, but it did enable the required competitive edge to be obtained.

Such examples of CABS success are not unique, nor to be fair are they common place. Had the change required been more technically difficult it would have been subject to a more lengthy timescale of response. However, from a user perspective the change was immediate, cost only two hours of management service systems support charge, and even more importantly enabled the implemented system to be a positive benefit to business development, rather than a hindrance, which can often be the case.

1.4 Increased Flexibility Of Solutions

In a competitive market place products have to change, new products are introduced and the IT solutions which support the business must be capable of responding quickly. Again, high quality data analysis and good design together with the ability to regenerate parts of the system using code generators will facilitate swift enhancements to key aspects of the implemented systems.

As stated by the example given in 1.3 above, the response capability must be able to reference both data and process flexibility requirements. This is especially true in the cases where there is a need for businesses to share data across systems boundaries. Change is the essence of all businesses, and any unnatural restrictions that are placed upon business genesis by data processing systems ensures business sub-optimisation and lost opportunity. Where such systems flexibility, as shown by the marketing system example in 1.3, is exhibited competitive edge can be achieved for the business by the application of the systems in the new business environment in short spaces of time. When one considers the need for such responsiveness in real time systems, as exhibited by the Stock Exchange, one can easily see the truly significant business advantage such solutions can give to organisations.

1.5 Shortage Of Skilled Staff/Increasing Workload

Much has been made over the last few years of the "hidden backlog" of systems work. Whatever the truth of that, there is a continuing growth in demand for information technology based systems. There has been a growing shortage of skilled staff to provide these systems since the industry came into existence. This problem will be severely exacerbated over the next 10 years by a reduction in the number of young people available to enter the industry. The demographic profile by age in the UK shows a population of 4.25 million 20 year olds in 1990 will have reduced to 3.25 million by the year 2000.

If it has not already been demonstrated that a need for improved productivity to reduce systems delivery times is necessary, it is essential for the industry to overcome this problem. The end result of this squeeze on human resources will be higher labour costs and a hugely increased unsatisfied demand for information technology systems.

It was noted earlier that the costs of developing solutions to business problems are unlikely to drop. This is because the reducing cost of computer resources is likely to be balanced by the increasing human resource costs and the cost of CABS facilities and environment itself.