A Study of End User Computing and the Provision of Tool Support to Advance End User Empowerment

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We find ourselves in a time of very dramatic changes and opportunities within the world of information technology (IT) and its use in commerce and industry. Over recent years, Personal Computers (PC’s), networks, robotics, automation, expert systems, Graphical User Interfaces (GUI’s), 4th Generation Languages (4GL’s), CASE (Computer Aided System Engineering) tools, Management Information Systems (MIS) packages, and user centred approaches to projects have all been introduced. They are all factors which give IT the potential of being highly influential with regard to whether a business organization operates at the maximum level of effectiveness and efficiency. However, it is widely recognized that we are currently faced with a business community who are largely not satisfied with the suitability of implemented software systems, and whose businesses are not benefiting sufficiently from the potential of IT (Worden 1989; Brooks 1987; Rauterburg & Strohm 1992). This has been referred to as the ‘software crisis’ (Swatman & Swatman 1992) but we would prefer to refer to this as an ‘information crisis’ as the software often ‘works’ but does not meet the business information system (IS) requirements.

One of the most significant developments over recent years has been the increased direct involvement of ‘business end users’ in the design and implementation of software systems using 4GL’s, spreadsheet packages, etc. The main constraint on this activity of end user computing (EUC) has been the restriction on the complexity and size of project that can be successfully handled. This is mainly attributed to the tendency for business end users not to have sufficient systems development skills (Sumner & Klepper 1987; Salchenberger 1993).

Our research has led us to conclude that there are business users who could realize significant business benefits if they had the use of a CAUSE tool. Such a tool would enable them to independently design and build complex computerized information systems. We provide details of research which is intended to lead to the development of a prototype CAUSE tool. The research includes the study of the sophistication of participants in EUC.

The increasing importance of end user computing (EUC) and the benefits that it brings to an organization are being recognized. We identify the characteristics of the various types of users involved in EUC. A number of risks are perceived to exist with EUC and we make recommendations for the management and control of EUC. An important area is that of intelligent tool support. We believe that the provision of such tool support would enable the concept of EUC to be further advanced. The characteristics and benefits of this type of tool are outlined. We refer to the required tool as a Computer Aided User Systems Evolution (CAUSE) tool - this emphasizes the intended central role of the business user, and reflects an evolutionary approach to end user systems development.

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Attention is also drawn to how this facilitation is expected to impact upon the prevailing information system crisis. We conclude by outlining how the suggested approach is to be realized by means of a research programme.

**The Growth in EUC Importance**

The reliance of a user, who is typically not a data processing (DP) professional, on IT to personally develop software is known as ‘end user computing’ (Amoroso & Cheney 1992). The different stages in the growth of EUC are shown in Figure 1.

Many findings have indicated the immense growth in EUC over the last 10 years or so (Alavi & Weiss 1985; Sumner & Klepper 1987; Davies & Davies 1990). Amoroso & Cheney (1992) observe that a prediction by Benjamin (1982) was reasonably accurate - that by 1990 EUC would have absorbed about 90% of the total computing resources in organizations. We recognize the contribution made to the growth of EUC by the trend towards individual empowerment - in terms of increases in power and authority of people at ever lower levels in an organization’s structure (Huff et al. 1992).

The findings of Ein-Dor & Segev (1991) support this notion in that they suggest that the intensity of participation in EUC is related to a combination of three groups of variables:

- organizational factors,
- management leadership,
- individual factors.

Furthermore their study showed that it appears to be the individual factors (for example personal motivation, rank/role in organization) which have a strong relationship with the intensity of EUC participation.

The introduction of networked personal workstations in recent years has reduced the cost of computerisation (in terms of hardware investment), and also (together with the proliferation of PC-based software) has precipitated the trend of transferring powers of choice and operation of software away from centralized IT departments to the business personnel intending to utilize or benefit from the implementations (Huff et al. 1992; Amoroso & Cheney 1992).

We support the view that there is an increase in demand for individual control over information and the design/operation of processing (Salchenberger 1993), and that this can be catalysed by computer automation (Boone 1991).

**Sophistication of Participants of EUC**

The paper by Huff et al. (1992) discusses findings from studies of end users (by interview and questionnaire) designed to test a method of measuring the sophistication of users involved in EUC. The method, partly based on the consideration of previous research (Rockhart & Flannery 1983; Nelson & Cheney 1987), recognizes three fundamental aspects to the level of EUC sophistication:

- breadth of EUC capability (knowledge and general skills);
- depth of EUC capability (mastery of IT features and functions);
- finesse (ability to creatively apply EUC).

We support this approach to identifying the EUC sophistication and recognize that there are significant benefits in making this measurement. It provides an organization with information useful in the formulation of their strategy for IS/IT development within the organization and also it allows the changes to the EUC sophistication profile of an organization to be compared over periods of time.

We suggest, however, that the evaluation of EUC could be made richer by:

- a supplementary consideration of the level of IS and business expertise;
- the role/authority of the individual end user;
- the effectiveness of their implemented EUC applications.

According to the literature, end users span the range from being non programming IT-naive users through to functional support users (defined by Rockhart & Flannery 1983) as non IT specialists who develop applications for other end users and themselves. Some also include professional programmers based in end user departments. However, different studies (Sumner & Klepper 1987; Quillard et al. 1983; Amoroso & Cheney 1987, 1991) show conflicting evidence of the percentages in each category that exist in industry.

Research has shown that the various types of end user involve themselves in EUC to different extents. Also, pro-
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