

Towards User-Oriented control of End-User Computing in Large Organisations.

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Abstract

Control is a major issue in end-user computing. The moving of responsibility, resources and authority from IT departments to user departments is frequently seen as a loss of power by the IT departments and an erosion of cost control by senior management. Reactions to this situation tend to focus on technology and formal control mechanisms. This paper contrasts such an IT-oriented view with a proposed, alternative user-oriented view. An IT-oriented view of EUC focuses on the problems it causes, the technology it requires, the methods that should be used and the means of limiting, controlling and standardising. An user-oriented view of EUC focuses on the problems it solves, the user's task and the organisational environment. The paper advocates a shift in EUC research away from the technology and the IT issues towards the political, social and cultural issues associated with the users. EUC problems are, in the main, organisational problems requiring a research approach which addresses dynamic issues emerging over a period of time. As a basis for such research, the paper proposes a dynamic model for EUC in which the progression of EUC within an organisation is visualised as a series of causal loops.

Introduction

The advent of end-user computing (EUC) catalysed by increasingly simple technology and increasingly sophisticated users has brought with it both solutions to problems within the information technology (IT) departments and new problems. While providing one solution to the so-called applications backlog, it has created new problems of control for the IT department, which, in some cases, has led IT departments to avoid supporting EUC, and consider outsourcing end-user training, the support of PCs and networks and the help desk. EUC has led to an increase in the work load of the IT department, a growing application backlog as EUC systems require repair and support from the IT department, and increasing conflict between users and the IT department as the IT department seeks to rein in the uncontrollable proliferation of EUC.

At the heart of these problems lies the issue of control of EUC. Robson (1997, p382) refers to EUC as user-controlled computing. Responsibility, resources and authority over IS moves away from IT departments into user departments. EUC within the organisation is affected by politics, culture and power within the organisation. Reasons for the proliferation of EUC may include the wishes to wrest control of IT from the IT department and to concentrate power within particular departments. The shift of control over IT resources to user departments has been associated with the duplication of computer applications, incompatibility and lack of integration, and low quality systems (Taylor et al, 1998). However, over-control of EUC by the IT department leads to alienation of end-users and conflict (Beheshtian & Van Wert, 1987). Many organisations consider the solution to the lack of control of EUC to be the exertion of more control from the centre. This IT-centred view of EUC sees EUC as a problem to be solved through standards, auditing, and financial control mechanisms which seek to make end users behave like IT professionals. Literature within the EUC field emphasises the need for management of EUC by the IT department through the use of restrictions on users (Alavi, 1988; Behseshtian and Van Wert, 1987; Ngwenyama, 1993; Taylor et al, 1998).

This paper firstly defines the IT-oriented approach to EUC control based on published research (Taylor et al, 1998). This is then contrasted with a user-oriented approach to EUC. A research agenda for studying EUC development from a user-oriented point of view is developed and supported by a model. It is concluded that research in EUC needs to address user motivations and the dynamics of end-user development within an organisation.

An IT-oriented approach to EUC

Many IT departments view EUC as a problem area. Valuable resources within IT are diverted to support amateur users who produce badly-written systems of no strategic value. There is a constant battle to halt the proliferation of various and incompatible platforms, to control spending, and to deal with problems caused by bad design and non-professional approaches to application development.

The case study described in figure 1 illustrates some of the problems. An IT department focused on mainframe and large systems alienates the small end-user whose needs are not being met. The availability of cheap PC technology provides a means for those users to take control of their computing needs. Through word-of-mouth and by example, the use of small packages spreads throughout the

organisation. IT finds itself faced with needs for support from a whole class of users who were previously excluded from organisational computing. The IT department is ill-prepared to meet the needs of the changing customer base. End-users consequently seek support elsewhere including non-IT departments and informal networks (Govindarajulu and Reithel, 1998).

The response of IT to such loss of control may be to adopt an authoritarian attitude by creating organisational rules for the use of PCs; for example, removing hard disks from PCs on client-server networks so that users must store applications on a central server; placing restrictions on the purchasing of computers; blocking access to organisational databases unless the EUC applications which may derive data from these database have been audited and approved; and refusing to support non-standard systems and software. Such IT-oriented solutions arise from the perception that the control of EUC is an IT problem. It is not seen that the IT department's problem may be the user's solution. Discussion of an EUC research study will further illustrate this.

Taylor et al (1998) identify some of the problems of EUC and conclude that part of the solution lies in the adoption of a systems development methodology by the end users. Based on case studies of 34 organisations, they identify duplication of effort, low quality of end-user developed systems and the lack of training of end-user developers as key problems. The research focused on IT departments and interviewing IT staff about EUC. This work provided a widespread and intensive survey of EUC within UK organisations from an IT viewpoint. It highlights the IT-oriented focus of EUC research.

The questions addressed in this work concerned the nature of EUC development and included:

- How is the development and maintenance of end-user computing applications carried out?
- How is the quality of end-user computing projects assured?
- How are end-user computing projects supported by the IT department?

These questions reflect the concerns of the IT professionals which may not be those of the users. The researchers used the case study material to identify several strategies for using information systems methodologies in the development of end-user computing projects: End-users should develop and maintain systems to the same standards as IT departments. They should adopt a 'cut-down' version of the IT department's methodology, tailored with the help of IT advisors to be contingent with the end-user department's needs. There is an underlying assumption that the solution to EUC problems is the same as that for IT department computing problems, namely the application of methods and standards; EUC problems will be solved if end-users become closet IT professionals. The advantages given for the adoption of methodologies in EUC are the reduction of duplication and maintenance problems, the improving of quality, security and recovery and the aligning of IT department and EUC systems (Taylor et al, p93). These may be seen as advantages from the point of view of IT who are interested in how computing is done. They may not be of relevance to users who are interested in what is done and why.

In summary, an IT-oriented view of EUC focuses on the problems it causes, the technology it requires, the methods that should be used and the means of limiting, controlling and standardising. A good outcome from EUC is defined in terms of the technical quality of the resulting application, the extent to which it follows the rules laid down by IT and the extent to which it integrates with IT's technology strategy.

A User-Oriented approach to EUC.

If an IT-oriented view of EUC focuses on the problems that EUC causes, a user-oriented view focuses on the solutions it provides. Control remains with the users and EUC problems are treated as organisational problems, not IT problems. For example, the duplication of applications and the redundancy of data that is often associated with EUC may be seen not as a result of a lack of IT standards and methods to be resolved by the imposition of control by IT, but rather as a symptom of an organisational problem. System duplication indicates organisational failure, not lack of involvement by IT. In one hospital, duplicate systems emerged as a result of organisational culture and politics: different specialties wish to assert their autonomy through the development of their own applications, and the control of their own data, raising barriers with other specialties and management (Hackney & McBride, 1995). Duplication of effort may arise from the hierarchical structures prevalent in organisations. Solutions to the duplication of systems may involve the restructuring of the organisation and the establishing of better communication channels. Technology, such as Intranets may be used to support the latter, but is provided as a means to achieve an organisational solution.

End-users tend to develop computer systems to solve problems of immediate concern to them. These immediate problems need rapid solutions, so time is a significant factor. End-users cannot wait for IT to produce systems (Fahy and Murphy, 1996). End-users may be uncertain as to the solution to the problem and wish to experiment. EUC may involve establishing information needs in order to reduce task uncertainty (Blili et al, 1998). The focus of the end-user is on the goal and not the means to the goal. In user-oriented EUC, quality considerations should focus on the quality of the solution and the resulting benefits rather than the quality of the tool produced to achieve that solution. An IT-oriented focus on code quality, documentation, backup and recovery misses the point of the end-user system.

End-user training is a key issue in EUC. Igarria and Zviran (1996) suggest that computer experience and training are key to effective EUC. Ngwenyama (1993) recognises the problem of end-user competence and proposes a solution based on collaborative action learning. Zinatelli et al (1996) identify computer experience and computer training as key factors in encouraging EUC sophistication. While there is little argument about the importance of training and experience, the nature of that training is open to debate. Some authors advocate an IT-oriented view which focuses on training in the technology, methods and standards. Taylor et al (1998) suggest training users in MicroSSADM. Other authors advocate training in tools and IS concepts (Alavi et al, 1988, Beheshtian and Van Wert (1987)). User-oriented EUC

training should focus on identifying problems and solutions and evaluating potential IT tools. Rather training that seeks to turn an end-user into an IT professional, training should focus on making end-users better at their tasks through the effective use of information systems, whether these are existing systems or are built by the end-user. IT issues such as database management, backup and recovery should be handled automatically by the end-user computing tool or handled sensitively in the background by IT professionals.

The use of a methodology by end-users may be regarded as an attempt to impose an IT culture on end-users. This culture may be foreign to the users (Ward and Peppard, 1996; Peppard and Ward, 1998). An IT-oriented view of the advantages of the use of a methodology in EUC may be interpreted by users as reasons for not using a method. Table 1 offers a possible user-view of each of the advantages given for the use of methodologies by Taylor et al (1998).

The control of EUC should remain with the user. IT involvement should be limited to providing advice, perhaps through the mechanism of information centres (Gunton, 1988; DeVargas, 1989; Khan, 1992), only if requested. Attempts by IT to control EUC and enforce an IT-oriented approach are likely to generate resentment and fail. Alavi et al (1988) suggest that EUC control should be enforced through line management and not by IS personnel. Beheshtian and Van Wert (1987) argue that, while IT should suggest standards and controls, it cannot be expected to enforce them since it is unlikely to have the authority or the resources. If IT is to be involved in EUC it may be done by relinquishing control of IT staff to the users. Govindarajulu and Reithel (1998) found that 62% of organisations in their survey had decentralised support for EUC by placing IT staff in user departments. In user-oriented EUC control of computing activities is taken away from IT. This recognises that EUC is an organisational issue, not an IT issue.

The removal of EUC control from IT, or any centralised authority, may enhance the risk of complications - system redundancy, data duplication, lack of data integrity. However, this may bring with it increased creativity, the extension of organisational knowledge, and greater opportunity of the creation of strategic information systems (Davenport, 1994; McBride et al, 1997). Effective solutions may be embedded in everyday experience and local knowledge; open experimentation by end-users should be encouraged; ideas should emerge from deviations from standards and from initiatives outside IT's development agenda (Ciborra, 1994).

In summary, an user-oriented view of EUC focuses on the problems it solves, the user's task and the organisational environment. Technology is provided unobtrusively as a background tool supporting the end-user in delivering business benefit. A good outcome from EUC is defined in terms of the quality of the solution provided by the end-user and the extent to which it contributed to business goals.

Research questions for user-oriented EUC

We would argue that a reframing of EUC research is required. Both the subject and the method of research need to change. EUC needs to be viewed from a user's point of view and not an IT point of view. Much of the survey work within information systems has solicited only the views of IS practitioners and largely ignored the views

of users (Galliers et al, 1994). While IT-oriented research on EUC focuses on IT problems (Taylor et al, 1998), user-oriented EUC focuses on end-users needs (Fahy and Murphy, 1996). Important areas of research concern the user's motivation, the nature of user tasks, and the role of the user within the organisation. The IT-oriented research questions of Taylor et al (1998) are replaced by user-oriented questions:

- What has motivated the user to start EUC?
- What are the user's objectives in doing some programming?
- What is the user's attitude to computing, to the IT department, to information?
- What is the primary focus of the problems the end user is tackling?
- What are the problems that EUC solves?
- How do those problems relate to the business's corporate objectives?
- Why do end-users ignore standards and guidelines?

Research in EUC should focus on motivation, attitudes, the development of experience and the triggers which cause or promote end-user computing developments. EUC emerges over time. Therefore a research approach is required which addresses the dynamic issues and discovers the emerging patterns and influence on the end-user's activities and attitudes. Static studies based on surveys or interviews will not reveal the complex and developing interactions which change the way computing is carried out within an organisation. Longitudinal studies are required which build up a history of the development of EUC within an organisation and demonstrate the emerging, cyclical patterns (Weick, 1979). Static studies, even when taking a case study approach (Taylor et al, 1998; Zinatelli, 1996) may not provide the rich detail required to interpret EUC development.

EUC arises from the complex relationships between groups, individuals and technologies. The motivation for EUC needs to be determined and the effect of EUC on user motivation analysed. EUC may increase satisfaction in work through providing self-expression, self-determination and intrinsic job satisfaction. Users can influence job design and determine their own information requirements. They can increase their skills, deriving satisfaction from the expression of those skills and from self-expression. It can be argued that EUC leads to greater job variety, complexity, autonomy and responsibility which may lead to greater job satisfaction (Katz and Kahn, 1978).

Interpretive studies are required which seek to examine the dynamics of EUC. These studies must ask how end-users produce change in their environment and identify areas of organisational change requiring further attention. The user of IT in mediating such change needs to be examined. EUC studies must understand how end-users interpret their organisational environment and impose structure on it; how they differentiate between figure and ground (Weick, 1979), that is between what is seen as interesting, important and worthy of focused attention and the background information that is assumed, taken for granted or ignored. The use of EUC may help in retaining and formalising the end-users interpretive structures; their understanding of their roles, processes and customers.

A Dynamic Model of EUC.

The progression of EUC within an organisation may be visualised as a series of causal loops (Weick, 1979) which develop over time. Effects within loops are amplified and small factors may take on great significance as EUC evolves. The progression of these causal loops may be best studied through case studies developed over time and historical analysis of the progression of EUC. The following paragraphs suggest some causal loops which may be used as a basis for developing a research model.

Technology Improvement

A key element of EUC is the availability of the technology. EUC requires cheap technology that is easy to use (Figure 2). However, the availability of the technology is necessary but not sufficient for the uptake of EUC. There must be group acceptance of the technology, and the establishing of an environment in which the use of computers is seen as socially acceptable. Social acceptability may emerge from management support, strengthened by the rules, norms and interpretations placed on the technology. We must ask: how does the management interpret the role of information technology within the organisation and its use by end-users?

IT Department Involvement.

The role of the IT department is crucial to the development of EUC. Many of the influences may be negative. For example, technology improvement may lead to increased demand for IT services. This in turn may lead to IT distancing itself from the user in order to minimise the resources being directed away from major operational IT projects (Figure 3). However, in a dynamic environment the effect of a factor may change suddenly. For example, while initially the lack of IT support increases EUC activity since demands for systems are not being met by IT, when the end-user subsequently hits development problems, the absence of IT support may act as an inhibitor of EUC since the user cannot proceed without advice and expertise which is not forthcoming.

The motivation for EUC lies in the need for the end-user to overcome problems which affect their operationisation of their day-to-day processes. The complexity of the problem leads to an increase in EUC as the problem-solvers seek to develop solutions which reduce complexity and make the operational situation manageable. Problem complexity may be influenced by the availability of improved technology which leads to greater demands from customers. End-users require rapid solutions to problems. Often time is a key motivation of the user to undertake her own system development. Both problem complexity and IT overload may be seen as increasing the time needed for a problem to be solved. Increased waiting may increase the motivation to carry out EUC.

Power Distribution

A third series of causal loops (figure 4) hypothesises the effect of EUC on power. Increased EUC may result in increased control of resources. This may lead to increases in autonomy and power within the user community. Furthermore the expansion of EUC may lead to increased computer competence. This may in turn lead to the development of new strategic applications by end-users which may increase their power base within the organisations.

Such models illustrated above need to be validated through longitudinal case studies. These studies need to recognise the importance of external influences on the development of EUC, the intimate link between EUC development and organisational dynamics and the effect of feedback which develops over time. Once understood and expanded as a result of case study research, these models will provide a practical basis for directing resources towards EUC, developing an appropriate organisational culture and optimising the use of information and communication technologies within the organisation.

Conclusion

The advent of Internet technology and the development as Intranets as the basic information infrastructure for an increasing number of organisations may accelerate a sea-change in approaches to IT management. Intranets offer end-users increased freedom from IT-oriented control of organisational computing. End-users are free to select the systems they want and to develop their own personalised information environments. The scale of this change may catalyse such a change in information management that end-user computing becomes the dominant form of organisational computing. A user-oriented view of EUC may become essential for both researchers and practitioners. The technological view of EUC control, centred round standards, methods and technological audits may not be an appropriate approach to a series of problems which concern organisational context, culture and politics.

A new view of EUC which focuses on user politics, culture and motivation, on the organisational environment and on the role of EUC in competitive strategy is essential. EUC research must draw out the organisational issues which drive EUC. A user-oriented view will enable a focus on user tasks and problems and the way IT can serve the user and solve the user's problems, not on the technology and the way the user can serve the technology. User-oriented EUC research may lead to alternative approaches to IT development and support. This may involve the use of component technology, the development of tailorable, evolving systems, and the use of disposable software to solve immediate problems. Flexibility and tailorability will be more important than structure and method. User-oriented EUC will be judged on business value and problem-solving success, not methodological rigor. New EUC research must be business-focused rather than technology-focused, understanding the motivations for EUC and the nature of successful outcomes.

IT departments have in the past seen EUC as a problem to be controlled and have shown a lack of empathy and understanding of the user's problems and motivation. In order to gain empathy and understanding, we must view the development of EUC within an organisation from the user's point of view. If the IT department understands the user's motivation, both explicit and tacit, it may be able to provide help both technically and managerially. That help must be anticipatory and unobtrusive. This paper identifies a research need, the outcome of which will help IT departments to understand EUC and respond appropriately.

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IT View	User View
Reduces duplication	Removes my autonomy and ownership of the data.
Reduces difficulty of maintenance	Removes dependency on me as the system expert, reduces the extent to which I am needed to understand the problem and my creative solution to it.
Improves quality	Reduces creative input, reduces my ability to develop an evolving solution which reflects who I am (my role in the organisation) and my ability to develop my skills.
Improves security	Reduces accessibility of system, reduces my ability to gain kudos by spreading my clever ideas around the department

Improves backup and recovery	Increases time wasted on non-essential, technical activities which I don't want to worry about because they are not part of the problem I am working on.
Aligns IT department and EUC	Allows IT to interfere with the way I work, increases IT's power and control which I am trying to break free of, reduces my independence.

Table 1. Contrast between IT's view and the user's view of the use of methodologies in EUC.

Figure 1: Case Study: BIS Health Care

BIS Health Care is a wholly owned subsidiary of BIS UK. Based at Swindon, it is the European centre for pharmaceutical manufacturing, employing 600 people on four sites. The IT Department consists of three sections:

1. Operations. Deals with running of the mainframe, management of user authorisations, and support of mainframe applications;
2. Database. Manages the Health care customer and product databases.
3. Information Centre. Provides user support for in house mainframe applications and user programmed mainframe applications, particularly user programmed database queries. Limited support of some PCs for technical users in the Research and Development areas has been provided in the past.

IT operations centred around the support of a mainframe running DOS /VSE.

In the last year as a result of the reorganisation of European operations of BIS, the mainframe has been moved to Reading. This has catalysed a move towards increasing use of PCs, which is causing serious problems for the Information Centre. The nature of the average user has changed. Rather than in-depth technical support for a few specialist packages, broad support is now required for users with limited computer knowledge. The number of calls to the Information Centre has increased dramatically, leaving the staff over-stretched.

The number of PCs within BIS Health Care is unknown. Many departments have purchased PCs for staff on internal capital budgets without the knowledge of the IT department. Requests by the IT department for information on numbers of PCs have been ignored, and new PC users are 'emerging from the woodwork almost daily'.

Relationships between users and the IT department are difficult. One user described the IT Department as 'a bunch of user un-friendly, customer un-focused techno-freaks.'

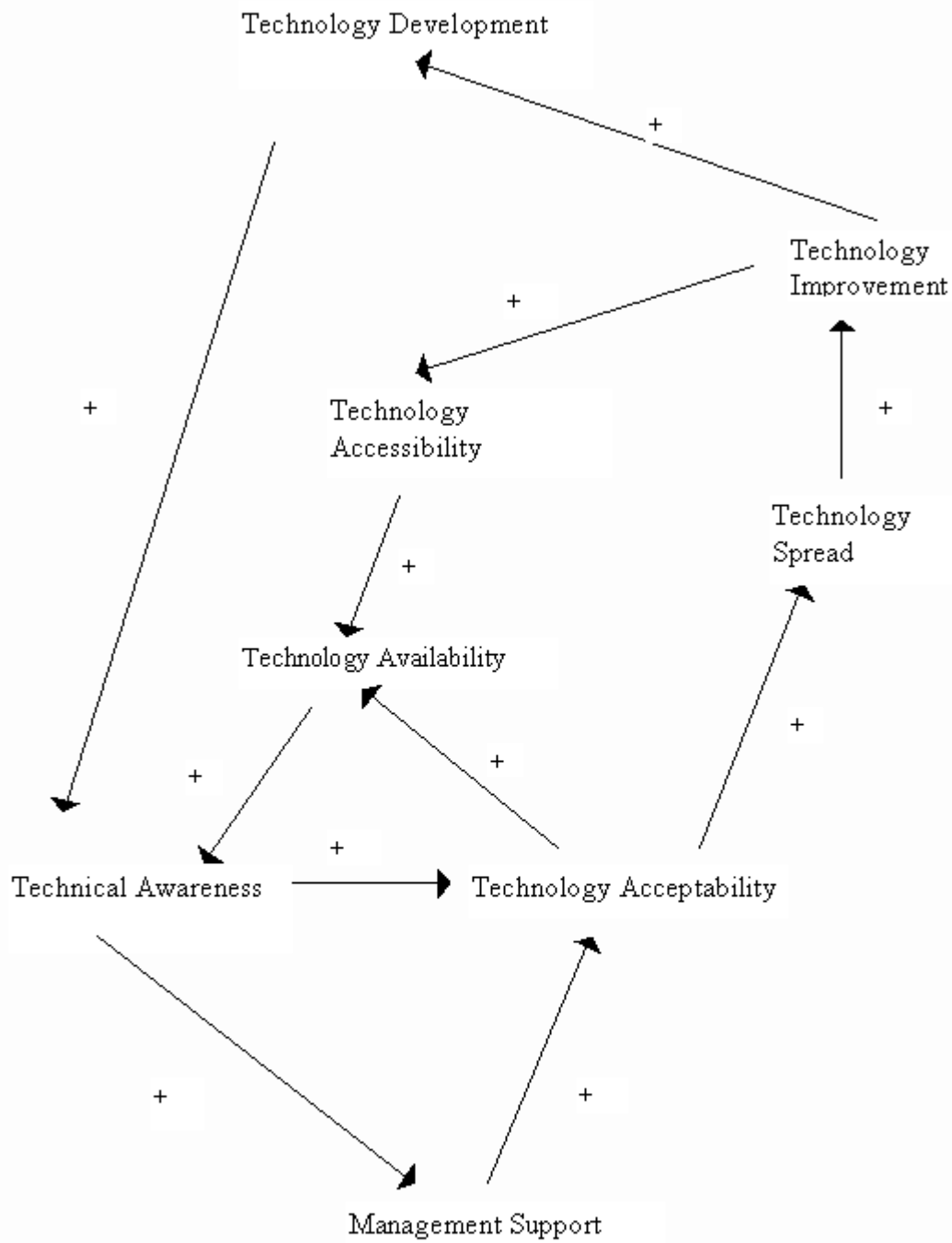


Figure 2: Technology Development

(+ indicates one attribute causes increase in another, - indicates one attribute reduces another.)

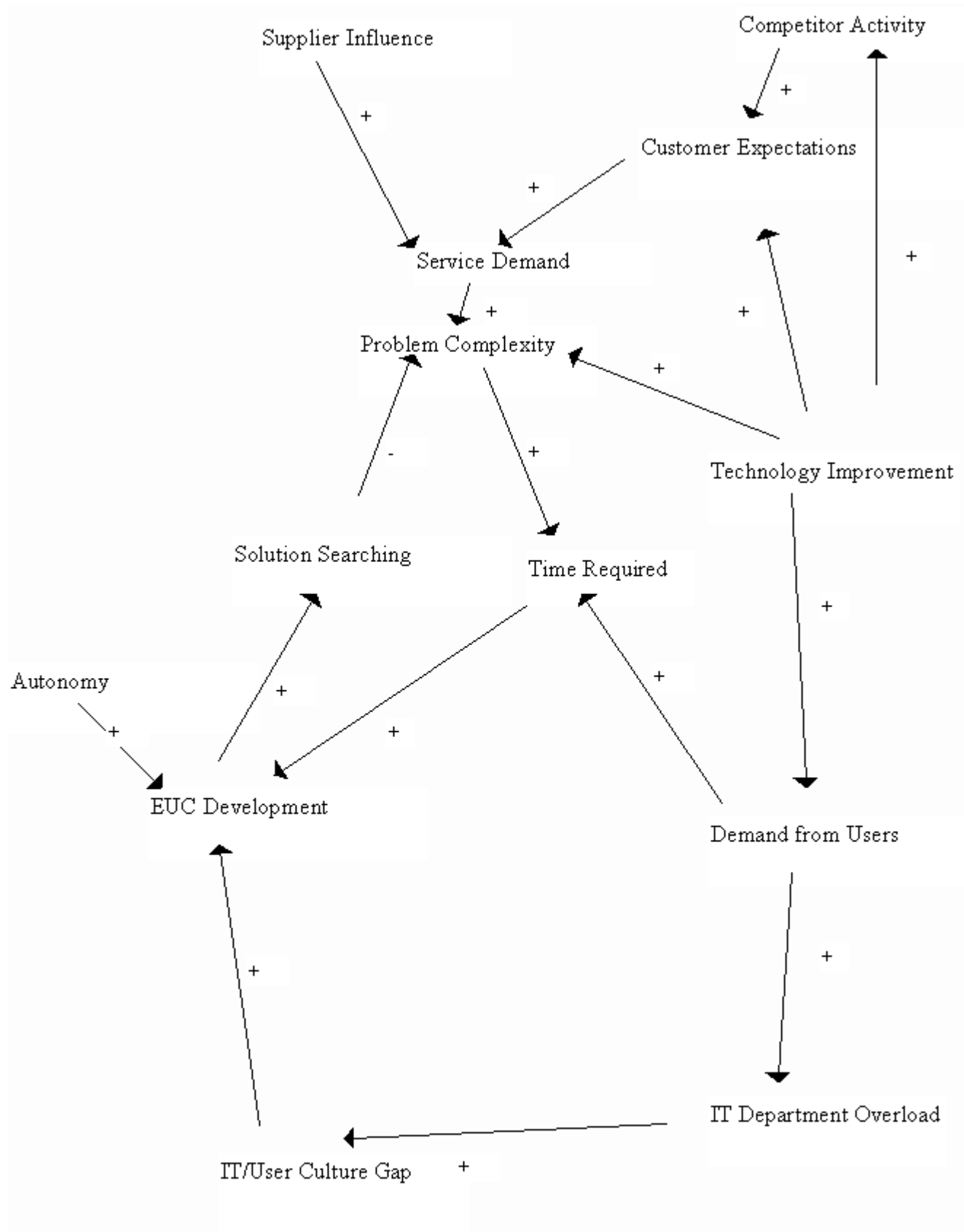


Figure 3: IT Department Involvement
 (+ indicates one attribute causes increase in another, - indicates one attribute reduces another.)

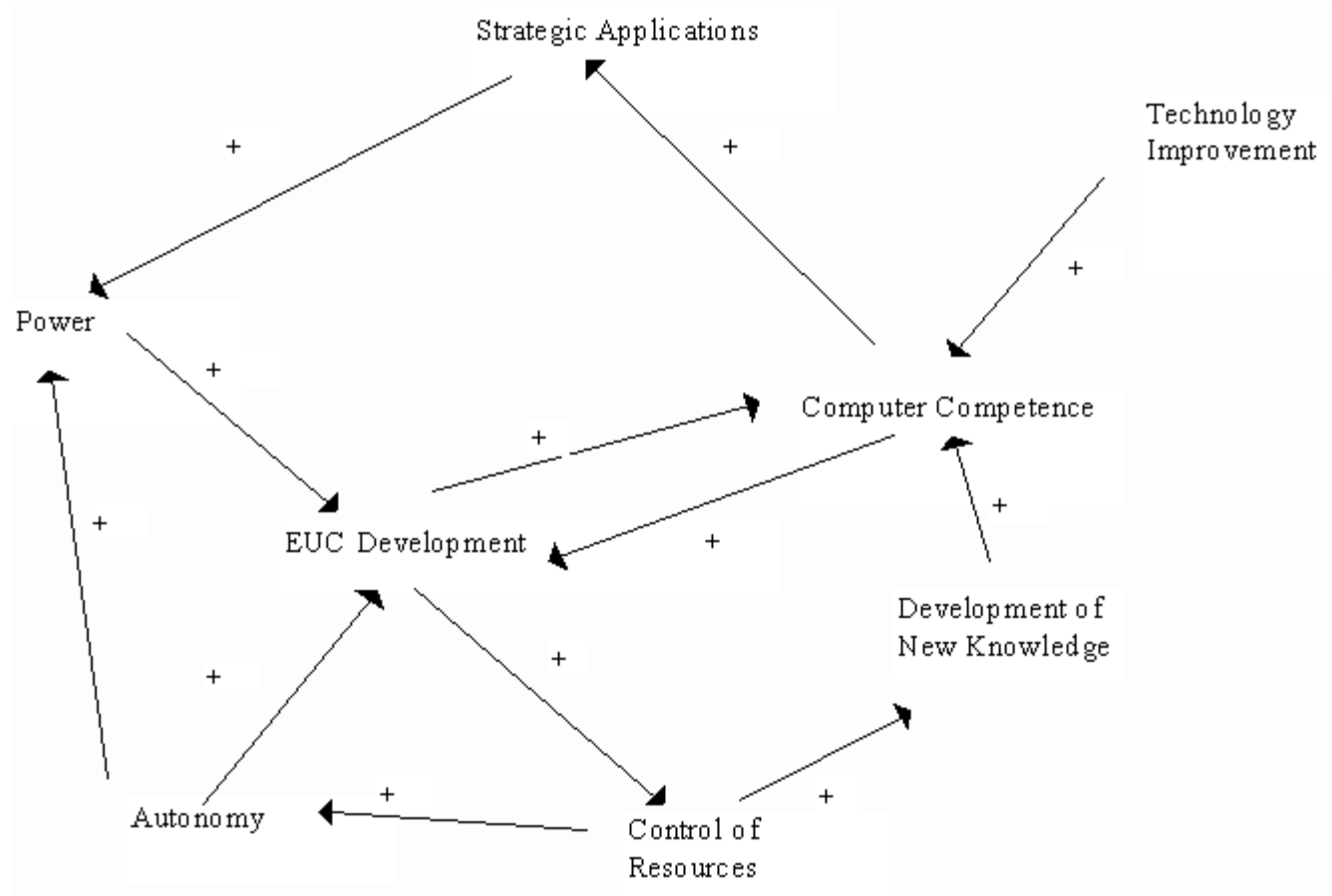


Figure 4: Power Distribution
 (+ indicates one attribute causes increase in another, - indicates one attribute reduces another.)