*Journal of Information Technology* (1990) **5**, 73–83

# Information systems successes and failures: research findings from the compounding industry

G. ROLAND KAYE

*CTI Centre for Accountancy, University of East Anglia, Norwich, UK*

**Abstract:** This study examines the perceived success or failure of information systems in the compounding industry. The study is balanced between a research enquiry and the consulting process with the client being the trade association. Following initial case study investigations, a postal questionnaire survey was undertaken of member organizations and individuals within them. Hard and soft data were collected about organizational structure, information systems and their characteristics, and users' perceptions. The findings emphasise the importance of user attitudes pre- and post-implementation, and their involvement during the systems analysis and design phases.

## Introduction

A request was received by the researcher from the Eastern Compounders Association (ECA) to investigate the introduction of information technology into their member organizations. During discussions with the ECA, it became apparent that its members would support a study into the successes and failures of information systems in their organizations.

As part of the management of agriculture and food supply, a series of regional associations were established within the flour, feed, and milling sector during World War II. While most of these associations ceased at the end of hostilities, the group now known as the Eastern Compounders Association (ECA) continues to the present day. The Association consists of over 100 companies, mainly in the east and south of the UK, varying in scale of operation and market.

Throughout their history, members have continuously introduced new production and distribution technologies and have not been slow to exploit computers in a range of applications from linear programming of feed formulations to control of blending and mixing plants. The concern is now focused on the introduction of new office and management technology. ECA members had expressed concern over the success of such systems and requested guidance on how to improve in this area.

Discussions were held with ECA on the nature and content of the study. This led to three visits from which case studies were developed (Kaye and Berry, 1987). From the preliminary work a description of the industry and the nature and range of its businesses and systems was obtained. This was followed by large-scale data-gathering to establish both an overview and a definition of the problem. The use of a postal questionnaire provided a route to such information. While it was recognized that much of the soft sensitive data needed to study user judgement of success would not be addressed by a questionnaire, it would be a means of identifying potential in-depth case studies. This article summarizes the findings of the postal questionnaire within a process model of change developed from the literature on information systems.

The article initially provides a review of the relevant literature on the introduction of information systems and the factors which influence their success. From this literature base a process model of change is developed. This model is then applied to the survey results to illuminate the factors which have influenced success and failure within the compounding industry.

## Research framework

In this section we develop the research framework which we used in our investigation. This framework was based on a literature survey of the factors influencing information system success and the process of development and implementation of systems. This literature survey brought together both empirical and theoretical evidence. The literature in this area is dominated by work from the USA and is often associated with large organizations which may limit its relevance to both the UK and the small to medium-sized business segments.

Factors in the success of information systems have been a topic of research from the early 1970s and are frequently found in management information systems (MIS) literature. Lucas (1975) found many factors

which caused information systems to fail, and identified five key areas to address in implementation to ensure the success of an information system. Technical systems quality was concerned with the accuracy, reliability, and timeliness of the reporting of information, ease of use, and clarity of reports to the user. He viewed the introduction of information systems as a change process in which the change agent or consultant gains support for change from the client's actions. Here, he identified the need for management support as well as user involvement and influence. The remaining three areas are closely related to the human side of information systems: attitude, decision style, and personal and situational factors. The general attitude towards automation can be a predictor of its use, and specific attitude a good predictor of the use of voluntary systems. The attitude may be influenced indirectly by the decision style present in both user and management, and this in turn will influence the use of the information system. In addition, personal characteristics such as age, education, and company service, can greatly influence implementation success. Lucas emphasized that systems implementers have some control over technical systems quality, but have little or no control over personal and situational factors. He called these factors 'hierarchy of influence'.

Lucas' framework may be criticized because it obscures many organizational and group dynamic factors by lumping them under the heading 'client actions' rather than sub-categorizing them into the key elements. Ein-Dor and Segev (1978) emphasized the influence of organizational context on the success of MIS. They identified both controllable and uncontrollable variables within the organizational context which would critically affect the outcome of any implementation. Uncontrollable variables included organizational size, structure, time-frame, and external environment. They suggested that if the uncontrollable environment was hostile, then any implementation would be abandoned. The partially controllable environment of organizational resources, maturity, and the psychological climate could, if it was hostile, create a modification in IS implementation. If, however, the partially controllable environment was benevolent, then the controlled environment was still required to assist the implementation process. This includes the rank and location of responsible executives and an appropriate steering committee.

Vessey and Tait (1986) used a contingency model to identify systems successes. Again, user involvement is critical in the system's outcome and is influenced not only by the system's impact, but also the complexity and attitude of the user. The contingency model has been much criticized but is still useful.

Another theory is a change process in which the user is faced by change resulting in attitude change pre- and post-implementation of an information system. In this, we measure the system by its success rather than by its objectives. This approach has been used by Brancheau and Davies (1986) in developing their innovation diffusion process. Innovation diffusion theory has been used to explain the introduction of innovations in all areas of technology; it is closely linked to marketing literature and seeks to further explain the development of the project life cycle. Diffusion is defined as the process by which an innovation is communicated through certain channels and adopted over time among the members of a social system, organization, or group.

This is a slow process and is often problematical for both the individual and the organization. An innovation is an idea, practice, or object that is perceived as new, and includes information technology (hardware and software) and its spread.

Research into innovation diffusion theory has examined not only the communication channels but also the phasing of adoption over time. (This phasing is the s-shaped product life cycle curve or learning curve.) A key feature of the theory is that it involves a social system, not only of individuals, but also of groups, departments, companies, and industries, nationally and internationally.

The attraction of innovation diffusion theory is the recognition of five key steps: knowledge, persuasion, decision, implementation, and confirmation. In the process of diffusion, we first become aware of the existence of something, are persuaded towards it, make a decision to use it, go through a process of implementation, and after implementation have our beliefs justified and the adoption confirmed.

Ives and Olson (1984) defined user involvement as a complex, multi-dimensional concept, consisting of a finite set of operations performed or not performed by the user, which may be classified by the type of user, the stage in the systems development life cycle where the user may be involved. More recently, Dray and Yelsey (1985) undertook a survey of 110 large companies with IS departments of which 75 per cent were experiencing problems. They identified factors which caused problems and factors shared by those enjoying success. Shared problem areas included insufficient strategic planning for new technology, lack of inter-departmental coordination and manager/employee communication during implementation, inadequate resources for training and education, lack of involvement by human resource specialists, lack of attention to ergonomics and ergonomic work place design, and low level of employee involvement in the implementation.

Shared success factors were attention by top management to issues relating to new technology, development and implementation of long-range plans, attention to coordination and function of areas,

creation of expert staff units to guide technology implementation, establishment of formal employee involvement programmes, support for education and training, creation and up-grading of ergonomic standards, emphasis on communication, fairness, and honesty, and open communication on issues such as performance monitoring and pay equity.

Based on this work, Neiderman and Brancheau (1987) developed a relationship between success factors and the diffusion process in which the diffusion loop is closed by a learning feedback into the initial screening process. The diffusion process is simplified into screening, introducing and evaluating. It contains the elements of change such as systems analysis, design, and implementation.

While Ein-Dor and Segev (1978) recognized the influence of uncontrollable variables, including the extra-organizational situation as well as organizational characteristics, an element lacking in these latter studies is the external environment in which the organization operates. This is surprising, given the many studies of key issues in IS management. Brancheau and Wetherby (1986) found the most highly ranked factor was 'improving information systems strategic planning' closely followed by 'using information systems for competitive advantage'. Clearly, then, the external environment and organizational performance in the environment are paramount for IS managers.

## Model

From the literature survey we developed a process model of change in which we could evaluate the results of the survey. This model has three distinct phases: initiation; change; post-implementation state. In the initiation stage we are concerned with the state of the environment, the organization and the elements within. During the change phase the elements will be subject to change either directly through the change process or as a consequence. The change process may be undertaken by alternative methods but the traditional systems lifecycle reflects the change phases. On implementation, training will have been completed and the users will then evaluate the system reflected in their attitude to change. The post-implementation phase provides a learning feedback which could permit improvements to be made in sub-sequent systems and implementations.

The model used to analyse change has the following structure:

- Time-frame: during any implementation there will be stages
- Situation: implementation will take place according to:
  - Environment: consists of both extra-organizational and organizational variables which are uncontrollable, and the partially controllable internal environment
  - Content: the primary elements of content are task, structure, technology, and people. Task is the subject of the information system. The structure is relevant to the function, subsystem, or organization. Technology is the change factor or agent. People are primarily the users, but also include managers.
  - Process: is the change involved during initiation and implementation as well as selection and application of methods of change.

The relationships of the elements of change are illustrated in Figure 1. We may describe the process of change as follows: first, a situation exists at time $T_0$. At this time, a state of equilibrium or tension exists in the environment as well as in the content. In the case of equilibrium, the first stage is the creation of disequilibrium through external or internal stimulation. The stimulation could be, for example, the change in the environment to low-cost information technology or a change in the trading pattern.

Stimulation causes a disequilibrium which results in a search for a new equilibrium state. The process of

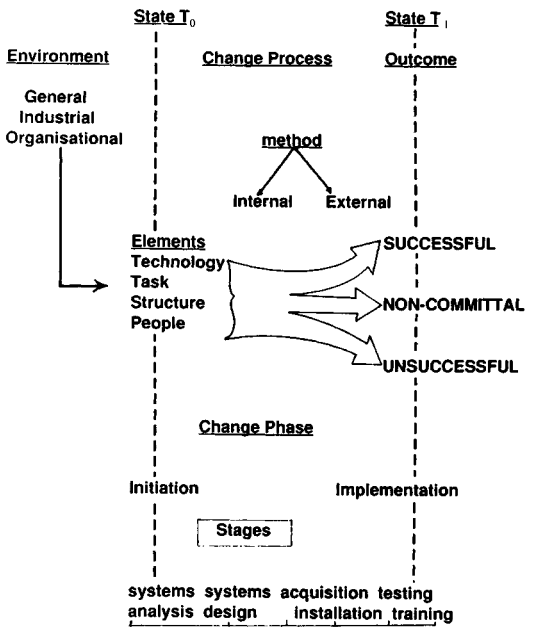


**Figure 1.** Exploratory framework

change from the state at $T_0$ to that at $T_1$ involves the innovation diffusion process stimulated by either external or internal change agents (consultants), managed by the respective managers and impacting on the users. The change process will pass through various stages during which alternative methods or strategies may be pursued. On completion of the change process, a new state will exist at $T_1$ which hopefully is an equilibrium reflecting implementation of a successful information system. If the state is one of disequilibrium then this would reflect an unsuccessful outcome which will eventually lead to further change but temporary tension exists.

## The compounding industry

From discussions with ECA, library studies and the three preliminary case studies (Kaye and Berry, 1987) an overview of the industry was constructed.

The basic activities of the compounding industry are milling, blending and distribution of products for human consumption and animal feed. There are importers and stock-holders of the raw materials required by the millers and blenders as well as merchandisers.

The industry, at least that part represented by ECA, is suffering from contracting markets. EEC regulations are seen as responsible for a decline in the size of the UK dairy herd, an important market sector. Many firms are being forced to re-appraise the size of their operations and the nature of their marketing activities. There is a wide range of firm size in the industry. The merchandisers are large in terms of staffing and profit, and count turnover in millions.

There is a high level of technical sophistication among members. Raw material acceptance testing was an early area of computerization and use of linear programming models to produce optimal blends is common. Computer control of blending and milling operations is also wide-spread. There is increasing interest in systems to assist in capturing and processing orders and to supply cost information for pricing decisions.

The industry can also provide a surprising contrast of Dickensian working conditions and electronic control boards, medieval stone grinding and high-tech packaging. The industry is historically family-based and regional, and adding to existing technology is more likely than replacing, product market extension as likely as vertical horizontal integration by merger and acquisition. Yet, to paraphrase one compounder, 'this industry where putting computer and machinery together is second nature and successful, cannot put computers and administrative procedures together with any real hope that benefits will occur'.

## Questionnaire

A two-part questionnaire was developed in early 1988 and was agreed with ECA committee members. Part I was designed to collect company details and to ascertain organizational characteristics including two type of IS in use, applications, IS personnel, management involvement, expenditure and IS strategy. It was addressed to the member organization but could be completed by anyone. Part II, sent to individuals, sought user views of successful and unsuccessful systems, the process of systems implementation and system characteristics. They were asked about IS applications, nature of hard- and software, experience, acquisition process, user involvement, and pre- and post-implementation attitudes. In total, 105 organisations were sent Part I and 133 individuals received Part II.

Despite a postal strike, 41 usable responses (38 per cent of the sample) were received. Because of the small number of replies, they have not been treated statistically, but more in the nature of case study responses. Table 1 shows a breakdown of responses to Part I.

**Table 1.** Analysis of responses

| | *Total* | *Percentage* |
|---|---|---|
| Nil responses | 52 | 50 |
| Ceased to trade | 7 | 7 |
| Don't know | 5 | 5 |
| No computer | 11 | 9.5 |
| Computer/no problems | 10 | 9.5 |
| Computer/no problems/details | 10 | 9.5 |
| Computer/problems | 1 | 1 |
| Computer/problems/details | 9 | 8.5 |
| Total | 105 | 100 |

### *Bias*

Since the survey is primarily of computing systems, it is highly likely that responses were biased towards those with computer systems. Only three 'small partnership or private limited' non-computerized companies provided details. One company described itself as 'consultants', another as 'animal feed flavourers'. Both had been trading for less than five years. The third company was a 'trader and wholesale/retail distributor' which had traded for more than 50 years. The turnover of all three companies was in line with the sample of computerized companies, but employee levels were lower at 'less than 10'.

Of computerized companies, only 19 provided comprehensive details as summarized in Table 2:

**Table 2.** Company type and size

| *Type* | *No* | *Turnover £'000* | *Sites* | | *Employees* |
|---|---|---|---|---|---|
| | | | *single* | *multi* | |
| Small | 12 | 4759 | 10 | 2 | 22.5 |
| Large | 3 | 16500 | 1 | 2 | 118 |
| Subsidiary | 3 | 87167 | 1 | 2 | 206 |
| Public | 1 | 349000 | – | 1 | >1000 |

A further element of bias may arise in individual responses to the success of systems. If the respondent was the systems developer, then pride of ownership may have encouraged responses which did not reflect user attitudes. If users were free to respond then they may have given more critical comments but were limited by their exposure to comparative systems. It is probable that in such a survey, people most likely to respond are those with a complaint to make about an unsuccessful system. We would therefore expect that the views given are probably biased towards those with unsuccessful systems, rather than those with successful systems. Multiple responses about the same system would provide comparisons and interesting future case studies.

Respondents were asked to identify successful and unsuccessful information systems and to indicate their attitude pre- and post-implementation. Results were analysed and, while some differences were found, the most striking feature was the change in attitude before and after implementation: in successful systems, 80 per cent were in favour before, and 100 per cent after. For unsuccessful systems, 31 per cent undecided and 69 per cent in favour before, and after 39 per cent were undecided, 46 per cent were skeptical, and 15 per cent were against. Even allowing for post-event rationalization, it would appear that there is a significant difference between successful/unsuccessful and pre-/post-implementation attitudes. Unsuccessful systems start from a position of weakness, perhaps reflecting users' lack of commitment or involvement.

## Factors influencing success

In this section we will integrate the findings of the survey with the change process model we developed earlier.

Ein-Dor and Segev (1978) suggest that if the uncontrollable variables in the environment are hostile then either implementation will fail or be delayed. They suggest that failure is likely to stem either from lack of appropriate funding, or inattention to the implementation process.

Only two companies indicated a steady turnover; the majority indicated growth, however seven companies ceased to trade in the period of the study. The rate of growth was in line with the general economy and inflation, supporting the view of a stable rather than expanding industrial sector. Stability of total turnover may reflect a static industry with some firms gaining market share at the expense of others.

The economic and social environment could best be described as turbulent (Ansoff, 1978) but the technological environment is benevolent towards information systems and their application in business. The industrial environment can best be examined through Porter's (1980) model of industrial structure and rivalry. The industry is primarily stagnant with growth being achieved by market share expansion or the introduction of substitutes and complementary activity. The relative balances of power with suppliers and buyers is low while the barriers to entry are low both in economic and technological terms. Consequently the opportunity for rivalry is large and has been resolved by oligopolistic behaviour by large and geographically related organizations.

The Bolton Report on small businesses (1971) suggests that employee numbers or turnover should not be used alone to categorize a business, but rather that each industry has its own levels (e.g. manufacturing, 200 employees or less, retailing £50,000 turnover or less, wholesaling £20,000 or less, agriculture excluded). Relative to previous studies, the sample reflected the distribution of the industry which is mainly small to medium size. High turnover was related to large company/subsidiary/public company status. In addition, only one case of a relationship of high turnover to multiple sites was found.

Increased complexity stemming from multiple sites, varied systems, and varied business activities tended to lead to increased risk of lack of success. However, multiple-site organizations were more likely to have an information strategy. Subsidiaries were more likely to have their information strategy and systems defined by head office. The sample was too small to establish a relationship to success of systems but it seemed to indicate a lower proportion of unsuccessful systems. The predominant systems were accounting systems. Organizations with systems personnel were more likely to have an information strategy.

The organizational environment, which reflects the size and structure of the particular firm, is partially controllable but influences the success of imple-

mentation. The size of an organization will influence success in two ways. First, small size will restrict financial resources and expertise and yet the proliferation of tasks is unlikely to be reduced. At the same time, the number of users who have to adapt is fewer and the hierarchy is smaller. Small organisations with limited internal expertise and resources are dependent on external expertise and their selection of technology but making consultants accountable and liable is problematical.

Eleven business defined 'food manufacture' as their primary business, four were primarily 'traders' while a further ten put this as their secondary activity. A further seven gave 'general agricultural merchant' as either their primary or secondary activity. Businesses which gave a high variety of primary activity also indicated a high variety of secondary activity. While this was a common feature within the industry, there was a substantial variety of activity both within the sample and within businesses. This lack of specialization is perhaps characteristic of some older small to medium-sized businesses which seek to optimize their use of assets such as vehicles and storage through diversification. There is insufficient data from this survey to comment on the success of such strategies, but diversification leads to the necessity for a variety of systems and general capabilities rather than specialization.

The responses to industry type, both primary and secondary, suggested that the compounding industry is neither homogeneous nor structured and many firms seemed to be highly diversified. This raised questions of the strategies being pursued and lack of information strategies reflected lack of long-term planning. Countering the view that hostile environments will result in failure, Hedberg and Jonsson (1978) suggested that uncertainty and threat may stimulate a search for new approaches.

From this study it would appear that:

- some organizations have experienced difficulty with implementation due to lack of resources resulting from industrial rivalry, and to general turbulence restricting economic capabilities
- some organizations have not been stimulated to look at new approaches including IS as strategic opportunities.

Businesses were generally well-established: six were over 100 years, six 50–100 years, five less than 20, and only two less than 5 years. The seven businesses which had traded for less than 20 years were all in the small partnership/company category. Businesses trading for fewer years were more likely to have less variety of activities.

The organizational structure, as defined by the range of activities and degree of centralisation, will influence success. The range of activities will result in increased complexity and variety in information system which will be problematic for IS implementation. Centralization is beneficial in establishing uniformity at the cost of user support. During the process of change, the level of user involvement and commitment of management will reflect their degree of communication with the change agent whether internal, external, or from head office. The partially controllable environmental variables of resources, maturity, and climate reflect their immediacy to the situation. Issues of growth and decline are reflected in the financial resources available and, generally, very low levels of expenditure on systems was the norm. Staff experience and knowledge reflect the level of expertise. While the existing state of technology forms both a baseline physical resource plus a level of experience, it also defines the action space available for change as well as influencing the elements subject to change. Maturity reflects not only the age of the firm but also the structure, conventions, product lifecycles and beliefs held. The maturity of the firm will influence the change process as mature systems are more stable but, equally, mature systems are hard to replace.

It appears then, that:

- if the uncontrollable variables in the environment are hostile then IS implementation will be problematic
- if the uncontrollable environment is benevolent and the partially controllable is hostile, then an adapted approach must be pursued
- if the environment is benevolent then the controllable environment, i.e. the elements and the change process, must be managed to ensure success.

### *The change process*

Use of internal or external change agents (consultants): the choice depends on available expertise (unlikely in the small to medium-sized company) and their sympathy and capabilities for the task. Unfortunately the IT industry has both reputable and unreliable operators, and buyers should be careful when selecting a technology.

Commitment and involvement of management is vital and yet this may be restricted by the environment as well as by the choice of manager and his/her attitude. The problems differ for the small and medium sized firm compared with the large organization for which many studies exist. In the larger organisation, the distance from the situation of change may be greater due to geographical or hierarchical factors, but this is unlikely in the small to medium-sized firm where it is likely that the manager is also a user so users may have higher involvement.

The role of users is vital as they are both the subject

of change process as well as the arbiter on its success or failure. Users' attitudes are influenced by their experiences during the change process but they also bring attitudes to the change situation. As has been indicated, users brought different attitudes to situations which resulted in failure compared with those associated with success. These reflected experience, education and training, culture, age etc.

It was noticeable that successful systems reflected users starting with positive attitudes arising from experience, involvement in all stages of innovation, or where training was given.

The unsuccessful systems, in contrast, generally started with less experienced users who were only consulted periodically during the innovation and received little or no training. It would seem that where users showed less commitment pre-implementation, then lack of involvement and inadequate training ensured failure.

The change process passes through many phases from initiation to implementation. These phases have many stages, the most visible of which are systems analysis, systems design, acquisition, installation, testing, training, and implementation.

The study showed that failure in communication between systems developers and users was a primary cause of lack of success. This occurred in and outside organizations, reflecting problems in the change process and methods used. Better methods of systems analysis and design are clearly needed to ensure appropriate, feasible, and acceptable programs and applications. It was evident that standard software, either tailored or not, predominated and was generally successful. This may be explained by the fact that a system which achieves 90 per cent of that required of it but saves 30 per cent of the cost or time will probably be deemed successful.

The acquisition process reflects the availability and demand for systems. Standard applications are available and well proven but specialists are unlikely to be found readily.

The problems at the testing, training, and implementation stages reflect the cumulative effect of shortcomings in the change process, increasing user awareness of the problems, and confirming of misgivings. Training must be substantial to overcome users' misgivings, build confidence, and ensure a successful outcome.

### *Technology, task, structure, and people*

Elements subject to change are technology, task, structure and people. Change in one element may be made deliberately or come about by changes in one or more of the other elements.

Technology is the change element in implementation, whether by the introduction of new hardware or new applications and software on existing equipment. However, where firms already had systems, not only did users have experience and expectations but also requirements could be more precisely defined. Consequently, systems which replaced existing systems were more successful than new activities, and conversions of existing systems rather than computerization of manual systems were the most successful despite problems of data conversion. Unsuccessful systems reflected failure to recognize the need for upgrade paths resulting in mixed incompatible systems.

Task type did not seem to have an impact on the outcome. The most popular systems were ranked equally as most successful or unsuccessful. Administrative and accounting systems were most popular; users were more stimulated and revealed more specific attitudes about these systems than about operational applications. This may reflect the sharing in such systems which showed up conflicting requirements and led to compromise. Dedicated systems were more likely to be used by experienced users who adapted.

The internal structure of the organization was not addressed in the questionnaire except in respect of subsidiary status and level of systems personnel. However, the effect of implementation on structure was indicated by changes in staffing levels and new activities. Very few organizations indicated lower staffing, while several indicated new activities. It would appear that systems more often led to expansion of activities within the existing structure.

The most significant impact on other elements and on the change process was made by people including users, managers and change agents (consultants). Their attitude determined success or failure and they in turn influenced the outcome through their attitudes and experience, both before and during the change process.

## Characteristics of unsuccessful systems

The previous section summarized the influencing factors on success but the importance of the survey was also to identify unsuccessful characteristics. In this section we provide a summary of the detail which did not always fit into our general model.

The most frequently cited success was also most frequently listed as unsuccessful. These were accounting systems, both for financial and management/cost as well as associated sales ledger. It was surprising to find successful implementation a problem in the case of financial accounting systems given the availability of systems and their tried and tested nature. However, variety of suppliers and lack of expertise in many companies indicated problems of choice. Both sales ledger and management accounting systems require a

match between the system and the business operations and this can be problematic for system developers and implementers. Users' lack of experience has a critical bearing on their expectations from systems, and accounting systems, whether manual or computerized, are problematic for many users and managers.

In two cases, the same systems were identified as being both successful and unsuccessful within the same organization. This supports the view that user perception is highly relevant and encourages our desire to undertake detailed longitudinal case studies.

*Systems:* The mix of successful systems was consistent with the overall sample with mini-based systems showing a marginally higher number of successes. Unsuccessful systems were evenly split between micro and mini systems. Successful and unsuccessful systems were cited where a great variety of systems existed.

*Bureau:* Only two instances of the use of bureau were found and both these involve an accounting firm undertaking the accounting function and operating the associated systems.

*Multi-user:* Use of multi-user systems, whether mainframe or mini based, were more likely in the larger or multi-site, multiple system firms. These systems tended to be more successful and more costly. There was no apparent increased evidence of information strategies, but where they were in existence, then the success rate was higher.

*Integration:* Systems with some level of integration tended to be more successful than those with none. The integrated systems tended to be towards the upper quartile of capital cost.

*Variety:* The variety of systems was greater as was the success rate where organizations had systems personnel, a user base, and previous IS experience. These organizations had both successes and failures but were more likely to learn from experience and better able to correct failures. They also spent more on information systems.

*Hardware/software:* A striking feature of the sample was the variety of hardware and software systems cited with no supplier/producer predominating. Extreme examples included small organizations using three makes of PC with no common operating system, thus denying integration and making data transfer impossible without expertise, which they did not have. No preference in make of hardware was indicated but the variety was considerable. Previous experience did not affect success but, overall, 'no previous experience' predominated, supporting the view that many inexperienced users would require support during analysis, design, and implementation stages, and training. Not surprisingly, use of PCs was predominantly found in the 'small' category while larger organisations displayed a variety of systems. Increased variety tends to require specialization and consequently increased experience and while both successful and unsuccessful systems occurred, predominant systems were successful, reflecting this.

*Micros/users:* Where the ratio of micros to users was less than 1:1 then: the variety of systems increased with varying degrees of integration; no information strategy existed; there was an increased rate of unsuccessful systems.

*Turnover/type of computer:* In very small businesses only PCs were found, otherwise no relationship between size and type of computer was evident.

*Software:* Table 3 lists the frequency of software in-total as well as in terms of success. In the section on pre- and post-implementation attitude, the categories of 'against/sceptical/undecided/in favour' were used. This parallels the classification of 'successful/indifferent/unsuccessful' used below.

*Acquisition:* The most frequently cited acquisition process was 'external supply based on internal analysis' (74 per cent) with a ratio of successful to unsuccessful of 2:1. 'External supply with external analysis' had a higher success ratio of 4:1 while internal development was the least frequent method (12 per cent) and least successful (1:1). The most frequently supplied external systems were standard packages with limited or no tailoring. Only two examples of external supply of bespoke systems were cited and both were successful.

*Software:* Standard packages were the most cited (58 per cent) of which seven (19 per cent) were tailored. The ratio of success to unsuccessful systems was lower for untailored standard packages (4:3) compared with tailored (5:2). Bespoke systems were cited (33% per cent) with 5:1 success rate. Turnkey systems were identified on three occasions of which one was deemed unsuccessful.

*User involvement:* Successful systems were associated with users involved at all stages (75 per cent) or consulted periodically (25 per cent). Unsuccessful systems generally involved the user to a limited extent or not at all (20 per cent), periodically (30 per cent), and all stages (50 per cent).

*Experience*: 36% of unsuccessful systems cited users with no experience compared with 24% in the case of successful systems. This was confirmed by the category 'very experienced' with successful (19 per cent) compared with unsuccessful (9 per cent).

*Training:* Given the lack of experience of users, the high proportion of users given no training in both unsuccessful systems (45 per cent) and successful

**Table 3.** *Successful and unsuccessful systems*

| *Type of system* | *Number of* | | *Total* |
|---|---|---|---|
| | *Successful* | *Unsuccessful* | |
| Stock control | 1 | 1 | 10 |
| Personnel records | | | 7 |
| Computerized mill control | 2 | 1 | 7 |
| Production scheduling | | | 3 |
| Feed formulation | 5 | 0 | 10 |
| Wordprocessing | 1 | 1 | 9 |
| Data base management | | | 7 |
| Sales order processing | 8 | 3 | 12 |
| Financial accounting | 6 | 1 | 15 |
| Management accounting | 3 | 3 | 12 |
| Transport scheduling | | | 2 |
| External data bases | | | 1 |
| Electronic mail | | | 8 |
| Quality control | | | 2 |
| Trading | 0 | 1 | 2 |
| Labels | 3 | 1 | 12 |
| Other – purchase ledger | 1 | 0 | 1 |
| – all | 1 | 0 | |
| – payroll | | | 1 |
| – samples | | | 1 |
| – warehouse | | | 1 |
| – scientific | | | 1 |
| – spreadsheets | | | 2 |

**Table 4.** In ranked order

| *Type* | *Total No* | *Proportion (%)* | | |
|---|---|---|---|---|
| | | *Successful* | *Indifferent* | *Unsuccessful* |
| Financial | 15 | 47 | 46 | 7 |
| Sales | 12 | 75 | 0 | 25 |
| Management | 12 | 33 | 42 | 25 |
| Labels | 12 | 33 | 59 | 8 |
| Stock | 10 | 20 | 70 | 10 |
| Feed formulation | 10 | 50 | 50 | 0 |
| Wordprocessing | 9 | 22 | 67 | 11 |
| Electronic mail | 8 | 13 | 87 | 0 |
| Personnel records | 7 | 14 | 86 | 0 |
| Mill control | 7 | 29 | 57 | 14 |
| Data base | 7 | 14 | 86 | 0 |

(25 per cent) exacerbates other problems. Only in the case of successful systems were any users given 'lots of training' (21 per cent)

*Implementation:* Users were asked to indicate at what stage in implementation was it noticeable that the system was wrong. Respondents gave multiple reasons as follows: systems analysis (54 per cent), systems design (31 per cent), acquisition (23 per cent), installation (38 per cent), testing (62 per cent), training (62 per cent), and usage (15 per cent), indicating increasing unease.

*History:* An important influence on attitude is previous experience of similar systems. Users were asked whether the system was a 'replacement for an existing manual system', 'superseding an existing computer based system', or a 'new activity'. Half the sample were 'replacing' and a further third were superseding, while the remaining (16 per cent) were 'new activities'.

The lowest proportion of successful to unsuccessful systems were in the area of replacement (1.4:1) followed by superseding (3.3:1) and new activities (5:1). It is reasonable to expect that success will be greater in the case of superceded systems since experience and shortcomings can be drawn on in developing new systems. Likewise, new activities are not influenced by preconceptions. Moving from manual to computerized activities was the most problematic for users.

*Attitude:* Users were asked to indicate their attitude pre- and post-implementation. Pre-implementation, 88 per cent were in favour of systems which proved successful as compared with 69 per cent for subsequently unsuccessful systems. This shift confirms user classification into successful and unsuccessful systems with 15 per cent against, 46 per cent skeptical and 38 per cent undecided.

*Constraints:* Users were asked to indicate constraints on unsuccessful systems. Of the sample, 38 per cent indicated cost, 8 per cent timing, 23 per cent company policy, 23 per cent expertise, and 31 per cent indicated no constraints.

Cost as a constraint may be linked to overall business success and this view may be supported by examining individual responses against the organizational data. All the organisations were experiencing below average growth in turnover with the exception of one organization which had only been trading for 2.5 years.

Expertise, measured as systems personnel, was very limited or nil in those citing expertise as a constraint. In one case, systems personnel were at head office and not localised. Where 'company policy' was given as a constraint, all organisations had an information strategy, in one case defined by head office.

*Criteria:* Users were asked to indicate using a Lickert 5 point scale the relative importance given to certain criteria in assessing system success. While all criteria were deemed important the overall ranking was:

| | |
|---|---|
| Quality of equipment | 4.6 |
| Task performance | |
| Additional information | 4.4 |
| User satisfaction | |
| Improved financial benefit | 4.3 |
| Cost/benefit | |

In addition, they ranked 'improved efficiency' as the primary justification before 'judgement' and 'objective measures'.

If improved efficiency is a criterion, then ranking 'quality of equipment' is surprising since it can only impact on efficiency through reliability. Task performance supports the view of doing more quicker, which is supported by the ranking of additional information. The low ranking of cost/benefit and objective measures support the view of failure to quantify.

## Conclusion

The survey has provided a rich picture of issues and situations as well as a framework within which to test ideas. The process model of change incorporated environmental factors as well as the systems elements within a time dimension which includes the steps of the change process. The findings support the view that users' attitudes prior to the introduction of change and the involvement they have during the process of change, will be vital to the success of the implementation. These attitudes will be enhanced by benevolent environments and by participation and appropriate training. However turbulence in the environment and its threat may stimulate the search for change.

Implementation of systems which build on previous experience of similar systems by both users and the organization are more likely to be successful than computerisation of manual systems. Proven systems tailored to situations are building on success while new systems require proving in a potentially hostile environment. The type of task application is unlikely to influence outcome, however dedicated systems do not suffer from conflicting requirements of shared systems. Management participation and commitment alongside that of other users reinforces positive attitudes and is persuasive of the uncommitted. The impact on structure is unpredictable but staff savings are illusory. The method of change will influence success with *caveat emptor* applying to both external and internal change agents.

An important factor in this study was the inclusion of small and medium-sized organizations. Small organisations tend to have restricted funding and expertise, but they also have restricted task sets with a limited number of users and a restricted hierarchy. They are dependent on external expertise with the problems of selection and management of consultants. Large multi-site organizations have increased complexity and variety which may be reduced by centralization at a cost to user involvement and commitment. The organizational maturity of an organization is both a restriction and facilitator of change as it brings expertise as well as entrenched attitudes.

The findings have provided confirmation of some of the literature and indicated the importance of management of the change process. To reach firmer conclusions, indepth case studies are required in which existing systems, ongoing implementations, and alternative user perspectives may be examined both pre- and post-implementation. Some interesting

aspects have emerged which support the view that there is a need for a thorough knowledge of the process of change if we are to achieve infor-mation systems success.

## References


Ansoff, H.I. (1978) Planned management of turbulent change, *European Institute of Advanced Studies in Management* working paper, 78–3.

Bolton Report (1971) *Bolton Committee Report on the Future of Small Firms*. HMSO.

Brancheau, J.C. and Davis, G.B. (1986) A model for the diffusion of end user computing. *MISRC-WP-87-07.*

Brancheau, J.C. and Wetherby, J.C. (1986) Key issues in information systems management: a Delphi study of IS Executives and Corporate General Managers. *MISRC-WP-87-09.*

Dray, S.M. and Yelsey, A. (1985) Impact of information and communication technology on Honeywell culture, organization and people. *Internal White Paper,* Honeywell Inc, Minneapolis.

Ein-dor, P. and Segev, E. (1978) Organizational context and the success of management information systems. *Management Science*, **24**, 10, 1064–77.

Hedberg, B. and Jonsson, S. (1978) Designing semi-confusing Information Systems for organizations in changing environments. *Accounting, Organization and Society*, **3**, 1, 47–64.

Ives, B. and Olson, M. (1984) User involvement and MIS success: a review of research. *Management Science*, **30**, 5, 583–603.

Kaye, G.R. and Berry, R.H. (1987) Study of the success of information systems in the compounding industry. *Management Accounting Research Conference, Aston University.*

Lucas, H.C. (1975) *Why Information Systems Fail.* Columbia University Press, NY.

Niederman, F. and Brancheau, J.C. (1987) Planning and managing technology change. *MISRC-WP-87-14.*

Porter, M.E. (1980) *Competitive Strategy – Techniques for Analysing Industries and Competitors.* Free Press, NY.

Vessey, I. and Tait, P. (1986) The effect of user involvement on system success: a contingency approach. *MISRC-WP-87-03.*

* MISRC-WP = Management Information Systems Research Centre, University of Minnesota.


## Biographical notes

G. Roland Kaye is Director of the Computers in Teaching Initiative, School of Information Systems, University of East Anglia.

**Address for correspondence:** Centre for Accountancy, School of Information Systems, University of East Anglia, Norwich NR4 7TJ, UK. Tel: 0603 507774 ext. 2312.

www.mana

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

www.manaraa.com