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**SWP 5/95    FACTORS AFFECTING INFORMATION  
SYSTEMS SUCCESS**

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## FACTORS AFFECTING INFORMATION SYSTEMS SUCCESS

*This working paper has been prepared by Grafton Whyte and Andy Bytheway and is based upon work undertaken by Grafton Whyte in the early stages of his PhD research.*

*It describes the theoretical foundations for a new project in the Cranfield Information Systems Research Centre, which is dealing with the assessment and management of success in the delivery of information systems.*

*(A shorter version of this paper is under consideration for publication in the International Journal of Service Industry Management.)*

**Key words:** *Information systems success, service management, user perceptions of success, repertory grid.*

### **ISRL CATEGORIES**

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### **ABSTRACT**

There is continuing difficulty in achieving success with information systems, particularly in the sense of meeting users' needs and expectations. This suggests that a fresh examination of the issues is needed in order that we understand better the causes of success and failure.

Much previous research in this area has adopted one of two perspectives: improving the *processes* of systems development, or the structure and content of systems *products*. This approach has had only limited success in dealing with the problem. A wider review of existing research literature suggests that, in addition to the process and product viewpoint, an important factor in achieving success in the general case is the *service management* viewpoint.

The question therefore arises: *is service important in the provision of information systems, and is it a factor in achieving success in the eyes of the users?* It is possible that service components exist which are unrecognised by those managing the development and use of information systems. If these components can be identified and understood, then they can be used to improve the overall level of success achieved.

By applying repertory grid techniques a total of 43 constructs have been found which relate to user's perceptions of success with information systems in business. Further analysis reduces these to 21 attributes which provide the basis of a new assessment and measurement framework. The use of these attributes in practice is illustrated using two cases: an information service provider and a hospital equipment supplier. Early experience suggests that software houses, commercial organisations and information systems departments can use these attributes as a management tool, and thereby improve the level of service and business benefit that they deliver to their customers.

## INTRODUCTION

### *Objectives of the paper*

The objectives of this paper are to:

- discuss briefly the concept of success and failure in the provision of information systems, and different views of the critical issues therein;
- review previous work that has addressed these issues and to introduce a project which set about dealing with them in a new way;
- explain in summary how the repertory grid technique was used to develop a new framework for understanding systems success, and to introduce that framework;
- draw conclusions and to explain the opportunity for further work.

### *Success and failure with information systems*

In the history of information systems in business it is probably true that there has been more failure and disappointment than success. Work by Galloway and Whyte (1989), Butler Cox (1986) and Lyytinen (1988) suggests that one in two information systems development projects will not lead to successful systems. Recent well-publicised examples of the information system industry's failure to deliver successful systems in the UK include the London Stock Exchange settlement system (the Taurus project), the Performing Rights Society system and the new London Ambulance Service call logging system. In France there have been major problems with systems for the national railways. Other examples can be found all over the world.

If end users are asked what they think about systems that have been delivered to them they are - at best - likely to display a degree of indifference. Experts working with information technology often perceive successful systems to be concerned with the successful use of the latest technology, and not at all with whether that technology was relevant to the user's needs. Project managers see success as a project which has been completed in the face of enormous difficulties (probably self-inflicted). These are signs of an immature discipline which is not yet understood and which therefore can not be managed properly.

### *Rationale for the research project*

#### *The need for a framework*

IT management and systems project leaders need to understand their users' view of success and what factors affect its achievement. Attempts to improve success with information systems have tended to be inward looking and have given inadequate consideration to the users' perceptions and needs. For example, much attention has been paid to the systems development lifecycle and the accompanying disciplines of project management and quality management. Although some attention has been given latterly to the interface between the information system project and the host business (for example in user requirements analysis, and later in testing and post implementation reviews) a framework is still needed with which to establish what the users' real longer term perceptions of success are, and the implication of these perceptions for systems development and delivery processes.

### *Product, process and service concepts*

It can be argued that there are different aspects or perspectives to the provision of information systems, leading to quite different views as to its improvement. Three which may be important (see Figure 1) are:

- the **product** which is delivered to the users (for example the software and hardware systems, user documentation and training courses);
- the **process** that creates the system (traditionally including systems analysis, technical design, program coding, testing and final handover);
- the **service** package which deals with the softer issues (answering questions, dealing with problems, or whatever else is needed).

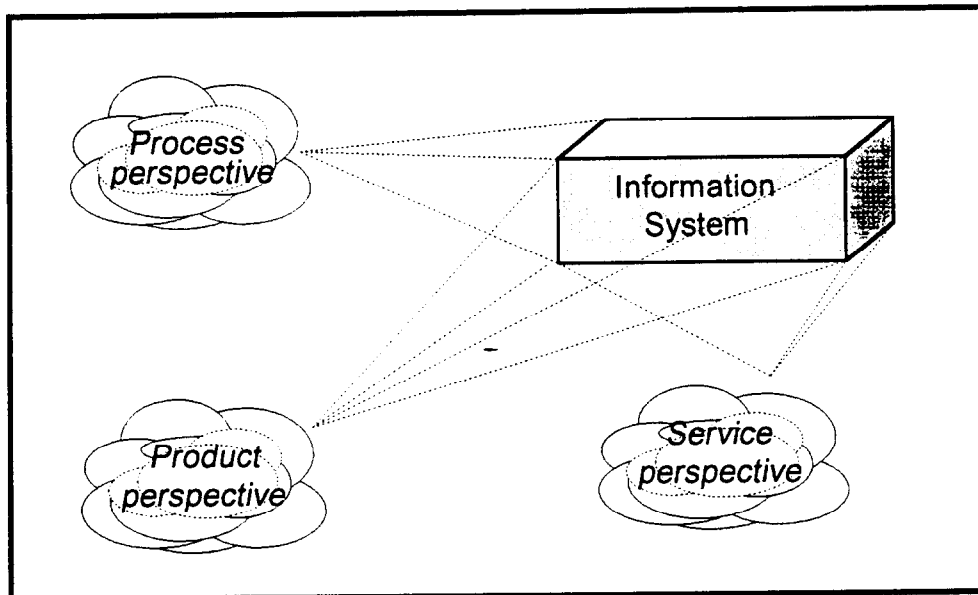


**Figure 1: Perspectives on information systems**

Most IS managers would, if asked, consider themselves to be delivering a service. However, the evidence is that these managers spend most of their time monitoring aspects of their operation which have little to do with service. Moreover, the overwhelming weight of research has focused on the product and process aspects of information systems, to the exclusion of almost everything else. The notion of service in information systems provision is still something of an illusion and our understanding of it is weak.

It is easy to understand the information technology industry's preoccupation with products, because the delivery of completed systems is predominantly what the industry is about. And then there is the information systems industry, which puts systems together and integrates the different technologies: their preoccupation is with the process as well as the product that it produces.

Business itself might fall into the same trap. If a business commissions a new invoicing system then all the systems development processes in the world - using all the latest software engineering

methods, tools and techniques - are not of themselves going to assure the successful provision of a billing system. The users' primary concerns are not directly with the product or process, but what the product will do for them and whether they are comfortable with the process.

### *Purpose of the paper*

This research project has been addressing these questions. The purpose of this paper is to report the early results of that work, and to present a framework within which a greater degree of understanding can be achieved. The work draws on models from the world of service operations and from the world of information systems evaluation. The approach to the work is rigorous; where much previous work has been speculative, this project has derived a new framework for the assessment of success by a careful process of research, interviewing and analysis.

## PREVIOUS WORK

### *Approaches adopted in previous general research*

Much research in the information systems community has chosen to deal with the product viewpoint. Studies into the determinants of success and failure have focused upon the more observable, tangible attributes and characteristics of systems products, such as response times, data volumes and the extent of systems usage. This is particularly true for the earlier research.

Increased systems complexity, the increasing number of unsuccessful systems and a growing systems development backlog led to a shift in attention from the product to the process viewpoint. Here we are concerned with the sequence of systems development and its relationship with supporting tools, development methods, project management techniques and the level of user involvement. Again, it is typical to concentrate on the more tangible attributes, such as the volume of documentation, the number of lines of clean program code completed and the milestones at which user approval is given.

Miller (1989) casts some doubt on the ability of product and process approaches to measure information system success, suggesting that process outcomes may not be able to be successfully measured. On the product side he, along with a number of other authors (Melone 1990, Srinivasan 1985), suggest that systems usage is beset by a number of complicating issues such as:

- whether use of the system is mandatory or discretionary,
- the influence of viable information alternatives,
- the effect that user experience has on usage, and
- the extent to which obtained information is actually used.

Measurement of tangible characteristics of information system projects is undoubtedly important but this should not be to the exclusion of the intangible characteristics which are more difficult to observe and measure such as "service quality" and the management of "user expectations".

Service Operations Management is an area of research which deals with some of the intangibles and therefore holds out the prospect of useful insights into the information systems problems facing technical and business managers. The idea that there might be lessons to be learnt by exploring existing ideas in the service management discipline was one of the primary motivating factors in setting about this research project.

### ***Approaches adopted in previous specific research***

In the specific area of information systems success, much research has been concerned with the project development process, no doubt in the belief that a successful development process will lead to successful systems.

A review of the literature suggests the following as being the main causes:

- over optimistic estimates that subsequently lead to the system being delivered late (Keen 1987; Galloway and Whyte 1989; Brooks 1975);
- projects running over budget again in most instances because of underestimation of the work involved (Keen 1987; Rademacher 1989);
- ill-defined project objectives, mostly arising from uncertainty regarding the business needs to be satisfied (Keen 1987; Lyytinen 1988, Rademacher 1989);
- lack of user commitment to the project and system (Keen 1987; Tait and Vessy, 1988) and poor communications (Whyte 1987; Illes 1990) typically between users and the development staff.
- the technical limitations of a system (Lyytinen 1988, Galloway and Whyte 1989), including systems which are unfriendly and inflexible and the use of inexperienced staff to develop systems (Illes 1990; Keen 1987; Rademacher 1989).

Work by Jones and Kydd (1988) and Galloway and Whyte (1989) suggests that these causes may themselves be symptoms of some other underlying problems or are instances of certain information processing problems. These underlying problems have been identified as *uncertainty* (the lack of information), *equivocality* (the absence of clarity, or excessive ambiguity in the project) and *internal inconsistency* (between the key elements of an information system project - for example the users, developers, tools and technology used in it).

### ***An IS development and implementation research framework***

To complement the product, process and service viewpoints, it is also possible to classify research according to the analytical approach taken. For example, it can be argued that there are four broad but significantly overlapping categories of analysis (Kydd, 1989).

- Technical approaches
- Behavioural approaches
- Organisational approaches
- Interactive approaches

#### ***The technical perspective***

Commentators from the technical perspective suggest that information system projects fail predominantly because of poor project management (Brooks, 1975; Hughes, 1986; Kuzman 1989; Morreale, 1985). This manifests itself in poor planning, poor estimating, and the choice of inappropriate technology or tools for the task. Also included is the recruitment of inadequately skilled personnel into the project.

Typically the sorts of responses advocated are ones that tend to be most used within the industry: structured methodologies, more rigorous project management methodologies and rapid development techniques and tools (Kaniper, 1986; Chandler and Holzer 1986; Simon and Davenport, 1987; Hughes 1986; Kuzman, 1989; Viskovich, 1988; Casher, 1984; Huling, 1987; Yaffe, 1988).

### *The behavioural perspective*

Work done taking a behavioural approach suggests that for successful project development more attention needs to be paid to the social and human issues that arise before, during and after implementation of a new system. For example, the lack of an adequate or sufficiently influential business manager sponsor (Doll 1985; Necco 1989).

Projects often fail for lack of a systems champion on the business side to assist the organisation in implementing a new system by managing the change process (Pinto and Slevin, 1987; Carroll 1982). Studies have also shown that, for certain types of project, a lack of user involvement throughout the process will lead to a greater likelihood of project failure (Tait and Vessey, 1988; Jones and Kydd 1988).

### *The organisational perspective*

Closely associated with much of the behavioural work are the studies taking an organisational perspective of the development and use of information systems and their complexity (Ginzberg, 1980; Rademacher, 1989). The suggestion is that a lack of attention to the organisational "fit" of a new information system and a failure to identify organisational "winners" and "losers" (when there is a shift in power due to the new information system) can seriously undermine the progress of a systems project.

### *Interactive approaches*

Studies taking the interactive perspective stress the problems that can arise due to the interaction of the technological, behavioural and organisational aspects of a new information system. The fit between technological features and the organisation are found to be relevant (Kydd, 1989).

One approach to overcoming these interactive problem has been the reliance on a key change agent or "hybrid manager" (Skyrme and Earl 1990) who because of their technical, political and administration expertise will be able to facilitate the integration of information systems and technology into the organisation.

### *Ideas for remedial actions*

In general the remedial action that most writers seem to agree upon is the need for is greater communication between all the interested parties in an information system project, both in terms of the quality and quantity of communications (Jones and Kydd 1988; Kydd 1989; Bostrom 1989; Kuzman, 1989).

Research which suggests information processing, internal inconsistency and communications problems as the main causes of information system failure illustrates the difficulty that arises from looking at product and process issues alone. What these findings suggest is that there is another area that needs to be investigated. This paper proposes that this is the area of service, or customer interaction. Morris and Johnston (1987) discuss this and argue that it is the feature which distinguishes a service operation from a manufacturing operation: a manufacturing operation will comprise "Materials Process Operations", whereas a service operation will comprise "Customer Process Operations".

Morris goes on to identify a third area: "Information Process Operations". It is the pervasiveness and intangible nature of this operation that makes the service elements of information systems operations difficult to identify. They are potentially unique and almost certainly difficult to manage.

### ***The emergence of the service perspective***

In the information systems industry the recognition dawned that improvements in the systems development process and systems products will, of themselves, not ensure success. Attention turned to user satisfaction as a measure of system success.

#### ***Some examples***

This area emerged into prominence with the work of Bailey and Pearson (1983) and shortly afterwards Ives *et al* (1983). Bailey and Pearson developed a 39-item questionnaire instrument for measuring perceived user satisfaction with information systems. Ives *et al* built on this work: they improved the reliability of the instrument and reduced it down to 33 items. They also produced a short-form of the instrument with only 13 items, and a 4-item general scale for measuring user information satisfaction.

Both instruments collected user responses using a semantic differential 7-point scale and calculated scores using the Wanous and Lawler satisfaction model. The instrument elicited user perceptions of the relationship with systems staff, their confidence in the system and the relevance of systems output to users' work. Factor analysis identified three factors as being closely related to successful information systems:

- the quality of the information product being supplied;
- the quality of systems personnel and services;
- the knowledge and involvement of systems personnel in the business.

A number of other studies into user information satisfaction followed, developing on the work of Bailey and Pearson, and Ives *et al*. Doll and Torkzadeh (1988 & 1991) produced a 12 twelve item instrument for measuring end-user computing satisfaction. The instrument identifies and measures five components of end-user satisfaction which are:

- the content of systems;
- accuracy of systems;
- format of reports;
- ease of use of systems;
- the timeliness of systems.

User satisfaction with information centres was the focus of research for Rivard and Huff (1988) they found that the following dimensions to be good predictors of information centre success:

- degree of user independence from the systems department;
- satisfaction with the set-up of the information centre;
- user friendliness;
- user attitude;
- satisfaction with the degree of support received from the information centre.

Magal (1991) in a similar study identified three dimensions of satisfaction:

- quality of the information centre service;
- quality of user-developed applications;
- degree of user self-sufficiency.

Clearly the focus of these studies is more upon service than systems products or processes. Melone (1990) suggests that a significant problem with research into user satisfaction is the questionable assumption that user satisfaction is a good surrogate for system success, as satisfied users alone are

not indicative of a successful system. It is possible to have systems which users perceive as successful but with which they are not totally satisfied.

Another key problem with results from user information satisfaction research is the range and variety of attributes and dimensions suggested to be closely linked to user satisfaction. This lack of commonality makes it difficult for a general model to be developed and applied with any confidence.

### *Service Operations Management research*

More recently research into characteristics of information system success have sought to borrow from the service operations field and have stressed the similarity between information systems departments and other internal services (Whyte 1987, Galloway and Whyte 1989, Kyu Kim 1990, Russell and Muskett 1993 and Watson *et al* 1993).

It is argued that services have the following unique features (Sasser *et al* 1978, Normann 1984, Gronroos 1983 & 1988, Voss *et al* 1985):

- service production and consumption is simultaneous, therefore cannot be inventoried;
- service is an activity or series of activities;
- service is intangible;
- the customer participates in the production process;
- the service is different for every customer.

### *Applicability to information systems*

Information system services have all of the above features. A user extracting information from a screen is producing and consuming the service simultaneously. It is an activity involving the user and the service of providing information is intangible. Due to the involvement of users in the delivery process, the service is always different.

Service is not only about 'substance' (that is, what the user gets from the service), it is also about how the service is delivered and the style of the business in question, especially at the customer-facing side of the business. In this context Gronroos (1983) refers to "technical" and "functional" quality dimensions; any interaction with customers (the functional dimension) might influence their perception of the products on offer (the technical dimension). This leads to the idea which lies at the heart of this project: it is essential to look *beyond* the case of information systems to find examples which illustrate the important principles of customer interactions.

### *Customer interactions and expectations*

Retailing provides some well known and useful examples. In the 1980's the two retailing chains Tesco and Marks & Spencer were perceived by many of their customers to be different. They supplied a similar range of products (although one had its origins in food retailing and the other in apparel) and the processes for delivering these products are also similar. However, the style of the two businesses was different (specifically: location of premises, ambience, quality of goods and ethos) and the result is that Marks & Spencer charged a premium price for their products, usually above that charged by Tesco<sup>1</sup>. In some sense, the customer perceived a different level of service to justify the higher price, and we see a clear example of customer choice based in service concepts. Success (in the eyes of the customer) derives from receiving the *expected* level of service and this is why they will return to their favourite store, whichever of the two it is. If the service is not

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<sup>1</sup> Today, of course, Tesco is a very different kind of business and would no doubt claim to have changed its market positioning significantly.

understood then there is a very high chance of disappointment and a consequent perception of failure.

Information system success might therefore have something to do with the way in which information system departments provide and then maintain systems for their users, and how they manage the expectations of users. If we can understand those expectations and how to measure and manage them better, the chances of success will be improved. Using service level measures we can determine whether or not we have succeeded in any particular instance, but we always have to remember that the key to providing successful information system is understanding user perceptions and the factors that influence them.

### *A service quality instrument*

Parasuraman *et al* (1988), Zeithaml *et al* (1988, 1990) identified some key service attributes, such as:

- *Empathy*: caring, individualised attention the company provides its customers
- *Responsiveness*: willingness to help customers and provide prompt service
- *Reliability*: ability to perform the promised service dependably and accurately
- *Assurance*: knowledge and courtesy of employees and their ability to convey trust and confidence
- *Tangibles*: appearance of physical facilities, equipment, personnel and communication materials and competence.

They argue that the effective management of these service attributes will lead customers to perceive the service operation as being of superior quality. The minimum goal for any service manager is to achieve a balance between customer expectations and perceptions of a service. As in the case of Tesco and Marks & Spencer, if customers understand what to expect and that level of service is what they want then they will not be disappointed.

Zeithaml *et al* developed an instrument for measuring service quality. The instrument consists of two sets of questions, one gauging customer expectations and the other gauging customer perception.

A service gap occurs when perceptions differ from expectations. Figure 2 illustrates aspects of the service model, and shows this service gap as "Gap 5". They argue that this gap between expected and perceived service is caused by four other gaps in the service these gaps are as follows (see Figure 2):

- Gap 1: a mismatch between the customer's expectation and the management's perception of the customer's expectation.
- Gap 2: a mismatch between the management's perception of customer expectations and the service quality specification.
- Gap 3: a mismatch between the service quality specifications and the service delivery.
- Gap 4: a mismatch between the service delivery and external communications to customers.

They propose a number of strategies for closing these gaps when they occur. The method for ascertaining which of these gaps is causing problems is by administering a series of further questionnaires probing particular themes for each gap.

The work by Zeithaml *et al* has been widely recognised as a significant step forward in our understanding of service and the factors that influence service quality. The model is now increasingly being adopted by information systems researchers as an alternative theoretical approach to the user information satisfaction approach (Kyu Kim 1990, Watson *et al* 1993, Remenyi and

Money 1994). They argue that if these service attributes were well managed then customers will perceive the service operation itself as being of superior quality. The minimum goal for any service manager is to achieving a balance between customer expectations and perceptions of a service. As in the case of Tesco versus Marks & Spencer, if we understand what to expect then we ought not to be disappointed, even if in the event we can not accept what is on offer - for whatever reason.

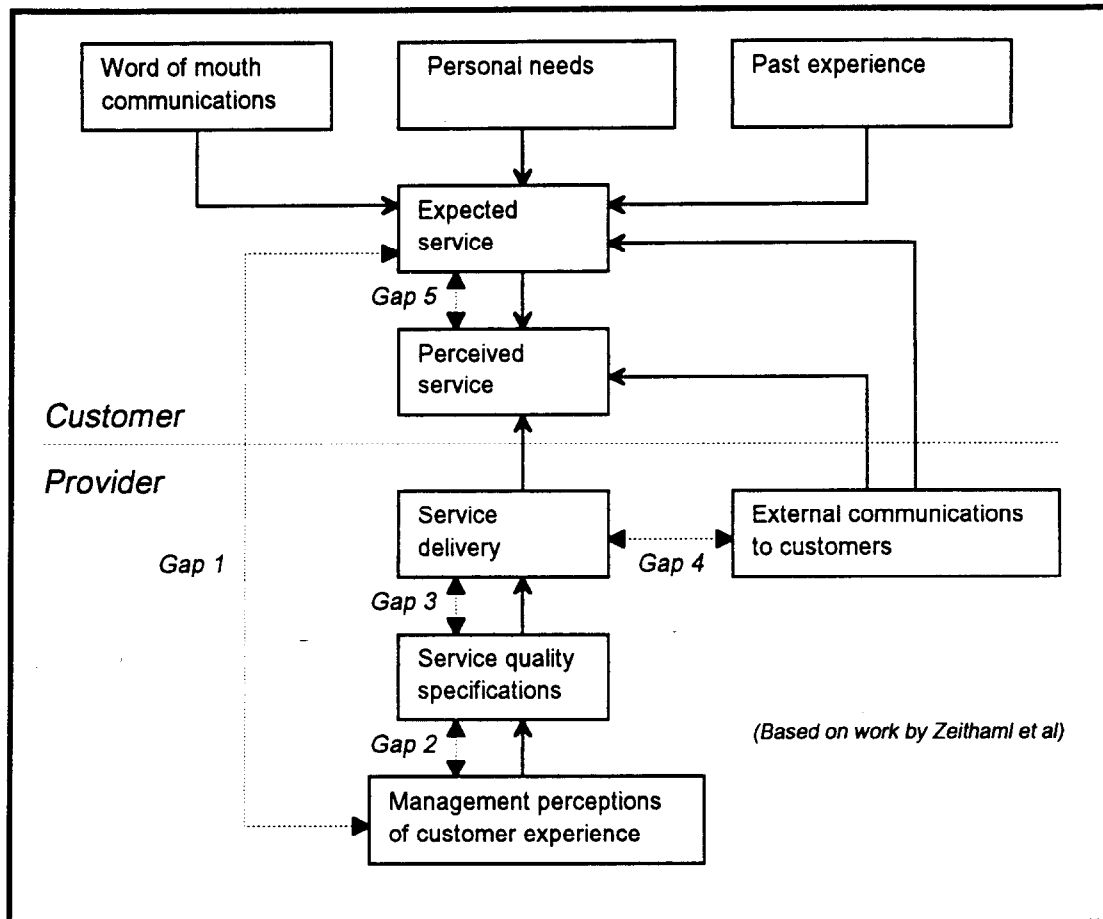


**Figure 2: A conceptual model of Service Quality**

There are however some shortcomings in the research. Haywood-Farmer and Stuart (1988) argue that the model addresses a host of peripheral aspects of a service but ignores core aspects. They suggest that service quality dimensions should be extended to include these core aspects. Zeithaml *et al* (1990) argue that the service quality model is a generic one which does have to be extended when looking at particular industries.

In the service quality model customers are asked to state their expectations of services which they may or may not have experienced, but this may not be reliable<sup>2</sup>. The service quality questionnaire is

<sup>2</sup> To illustrate this point, user requirements analysis in information systems (asking users what they want from a new system) tends to produce a 'wish-list' where a significant proportion of what is "requested" is not "expected", and may not actually be wanted at all. There seems to be a tendency to exaggerate the requirement or importance of a facility; there is a danger that the approach used to elicit customers expectations may be

reduced to the minimum number of dimensions and items. Customers are asked to complete the whole questionnaire irrespective of whether the items are relevant or not. If customers stated an opinion on items which normally they might consider to be irrelevant then this might affect the overall results of the survey.

The use of multiple questionnaires to probe Gaps 1 to 4 raises the possibility that these subsequent questionnaires could have been measuring something different to the results of the first questionnaire which measured Gap 5. There is an assumption in the service quality model that Gap 5 is a function of Gaps 1 to 4, however the link has not been established as either equivalent or complete.

### *A new approach*

The work of Zeithaml *et al* in this area of defining user perceptions is clearly important, but the work reported here has made no assumptions that could later invalidate the results: it has been taken from first principles and has redefined the attributes of successful information systems without recourse to existing definitions. The work of Zeithaml *et al* is principally in consumer-based services, which tend to be more transaction oriented and do not mirror the long term relationship found between information systems and their users.

In this respect research into user perceptions of systems success needs to take account of relationship marketing, where there is a focus on longer term relationships. In a relationship marketing approach, it is argued that successful ongoing relationships with external customers depends upon the successful management of its internal markets (Christopher *et al* 1991, Clark *et al* 1993, Collins and Payne 1991). One of the most important is the internal market for information systems, because of the pervasive nature of the information systems product.

All of these observations and factors led to the initiation of this project, which set itself the task of developing a new service oriented framework for understanding information systems success.

## **RESEARCH METHOD**

The objective of this research was to identify attributes of successful information systems, as perceived by the information systems' users. It was necessary to find a method which would enable the extraction of these perceptions without researcher interference or bias. A number of approaches were considered from simple semi-structured interviews (semantic differential) to the use of bodies of experts (the Delphic approach).

### *Repertory grid technique*

The approach which was chosen was the repertory grid technique developed by Kelly (1955) within general personal construct theory. Kelly suggests that people make sense of their world by continually interpreting the events around them through a set of constructs. This process of continual interpretation he called "construing".

Through this process of construing, an individual builds up a repertoire of constructs by which he orders his view of the world and tries to anticipate events. The basic assumption underlying personal construct theory is: if we can understand someone's attitude (their "constructs") towards some specific thing ("element" or "elements") we will be better able to predict that person's behaviour towards that something (Vyakarnam, 1989).

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prone to the same kind of exaggeration.

This method supports the intended application of the research: if we can understand how through their attitude users perceive (through "constructs") information systems (the "elements" in our case), we will be better able to predict those systems that they will perceive to be successful.

### ***Elicitation procedure***

Using as a basis the Repertory Grid technique an elicitation procedure was set up for extracting elements and constructs. The following were the main steps in this procedure:

1. The respondent was introduced to the research and the nature of the interview was explained.
2. The respondent was asked to: *"list 8 information system products with which you have been personally involved either as a user, manager or developer. It does not matter at what stage the system product is at now"*. They were also asked to identify those products they would consider the best or worst, and to this list was added a ninth, the "ideal system".
3. These elements (the information systems products) were presented back to the respondents three at a time in a set numerical sequence (Kelly's triadic method). At each step the interviewee was requested to: *"please specify in some important way, how two of the products are alike and thereby different from the third"*. In this way the respondent's constructs were elicited. To the resulting list was added the successful / unsuccessful bipolar construct (Fransella and Banister, 1977).
4. The final step in the process was to ask the respondent to assign a score between 1 and 7 for each element against each bipolar construct, the score indicating the proximity (in terms of the person's perception) to either extreme of the construct.

The result of a typical 90 minute interview was a matrix of about nine elements and nine constructs, yielding 81 individual scores. Ten respondents (from all organisational levels except director level) were interviewed from two companies, a global financial information service provider and a major public utility, both with headquarters in London. A total of 30 different information systems were analysed, the criteria being that they should be:

- supporting at least one department within the business;
- supplied by the information systems group within the business.

This fairly open approach was deliberate in order to a wider rather than a narrow set of samples at this stage<sup>3</sup>. The constructed elicited from these interviews are tabulated in Table 1 below.

The repertory grid technique worked well. Its main strength was its ability to elicit relevant attitudinal data very easily, without the need for long exploitative discussions. Also, it was easy to avoid imposing the researcher's views on the interviewee.

### ***Results of repertory grid analysis***

The data gathered from these interviews allow the relationship between the constructs and success to be analysed. The results from these analyses (using the INGRID program) have been summarised in Table 1.

The analysis identified those constructs (first and second columns) that correlated closely with success (third column), and those constructs that emerged as significant in a principal component analysis (fourth column). It also showed the frequency of occurrence (fifth column). The first

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<sup>3</sup> There are comments about the constraining of the samples in different ways in later sections of this paper. The research design was such as to address the question of tighter constraints in later stages of the project.

nineteen construct items appeared to have significant correlation to perceptions of information system success, with coefficients of greater than 0.9 (positive or negative - the negative results indicate close correlation to information system failure). All results were significant to 95% degrees of confidence.

In this way the interviews identified 43 different constructs which all appear as significant at least once in the principal component analysis and 19 of which are significant in the correlation analysis. Not all constructs survived the significance tests: constructs such as *timeliness* and *implementation quality* were among those mentioned by interviewees that failed to emerge as significant in the analysis. For each respondent the two most significant components were reviewed and were found to account for at least 63% of the variation in each case.

| Constructs                                         | Un/Success correlation | PCA | Frequency (n=10) |
|----------------------------------------------------|------------------------|-----|------------------|
| 1 User friendliness                                | x                      | x   | 10               |
| 2 Responsiveness of personnel/developers           | x                      | x   | 1                |
| 3 Reliability of systems and personnel             | x                      | x   | 1                |
| 4 System design or specification                   | x                      | x   | 4                |
| 5 Data accuracy                                    | x                      | x   | 3                |
| 6 Project management                               | x                      | x   | 2                |
| 7 Requirements driven by systems or business       | x                      | x   | 2                |
| 8 Developers understanding of the business         | x                      | x   | 1                |
| 9 Marketing of system                              | x                      | x   | 1                |
| 10 Management reporting                            | x                      | x   | 2                |
| 11 Integration of systems                          | x                      | x   | 8                |
| 12 Operational reporting                           | x                      | x   | 1                |
| 13 Maintenance of system                           | x                      | x   | 3                |
| 14 Documentation                                   | x                      | x   | 2                |
| 15 System essential for running the business       | x                      | x   | 4                |
| 16 Auditability                                    | x                      | x   | 2                |
| 17 Controls (data input and removal)               | x                      | x   | 3                |
| 18 System supports the business (meets objectives) | x                      | x   | 6                |
| 19 Training on using the system                    | x                      | x   | 2                |
| 20 Screen design                                   |                        | x   | 1                |
| 21 Level of paperwork system causes                |                        | x   | 1                |
| 22 System response times                           |                        | x   | 2                |
| 23 System accuracy (functional)                    |                        | x   | 2                |
| 24 System regularly enhanced                       |                        | x   | 1                |
| 25 User involvement                                |                        | x   | 3                |
| 26 Speed of turn-round of changes                  |                        | x   | 1                |
| 27 Post implementation support                     |                        | x   | 1                |
| 28 System intelligence                             |                        | x   | 1                |
| 29 Package or tailored system                      |                        | x   | 1                |
| 30 Data duplication/Data integrated                |                        | x   | 4                |
| 31 System complexity                               |                        | x   | 5                |
| 32 Expert support personnel                        |                        | x   | 1                |
| 33 Flexibility of the system                       |                        | x   | 1                |
| 34 Local data manipulation                         |                        | x   | 3                |
| 35 Cost collection system                          |                        | x   | 1                |
| 36 Automatic data capture                          |                        | x   | 2                |
| 37 Data quantity                                   |                        | x   | 1                |
| 38 Level of functionality                          |                        | x   | 1                |
| 39 System evolving                                 |                        | x   | 2                |
| 40 Provides adequate information                   |                        | x   | 1                |
| 41 Encourages efficiency                           |                        | x   | 1                |
| 42 Common user interfaces                          |                        | x   | 1                |
| 43 Provides customer with information              |                        | x   | 1                |

The surviving 43 constructs were reviewed and then reduced to 21 *attributes*, by a process of inspection, semantic analysis, expert review and (ultimately) validation by the original interviewees. These attributes and how they map back to the original 43 constructs is shown in Table 2. The first column indicates the constructs from which the attributes were derived, and the second the chosen name of the attribute. A new frequency indicating the number of respondents referring (indirectly through constructs) is also shown in the third column of the table.

| Table 2: Attributes emerging from constructs |                                 |               |
|----------------------------------------------|---------------------------------|---------------|
| Construct Number                             | Attribute                       | New Frequency |
| 5, 23                                        | Accuracy                        | 5             |
| 18                                           | Business Alignment              | 6             |
| 32                                           | Competence                      | 1             |
| 31                                           | Complexity                      | 5             |
| 7, 29                                        | Direction                       | 2             |
| 14                                           | Documentation                   | 2             |
| 41, 28, 34, 36, 40, 38, 33, 37, 22, 21       | Effectiveness                   | 7             |
| 1                                            | Friendliness                    | 10            |
| 43                                           | Front Office                    | 1             |
| 11, 30, 42                                   | Integration                     | 8             |
| 9                                            | Marketing                       | 1             |
| 15, 35                                       | Necessity                       | 4             |
| 6, 16, 17                                    | Control (Process & Operational) | 4             |
| 3A, 3B                                       | Reliability                     | 1             |
| 10, 12                                       | Reporting                       | 2             |
| 2                                            | Responsiveness                  | 1             |
| 4, 20                                        | Specification                   | 4             |
| 19                                           | Training                        | 2             |
| 8                                            | Understanding                   | 1             |
| 13, 24, 39, 26, 27                           | Upkeep                          | 4             |
| 25                                           | User Involvement                | 3             |

## ANALYSIS

The results of this research suggest that there is a set of core attributes, presented in Table 2, each of which is likely to influence a user's perception of information system success. It follows that the overall recognition, understanding and management of these attributes is very likely to be important in achieving success with information systems in business.

The analysis demonstrates one strength of the repertory grid, which is the high volume of usable data that becomes available from a relatively low number of respondents. From this volume data the derived attributes have a high level of significance.

### *Nature of the attributes*

Attributes fall into different categories. Attributes such as:

*accuracy*  
*business alignment*  
*effectiveness*  
*(user) friendliness*

are perhaps obvious and so that one would expect them to appear. Attributes such as

*competence* (of systems personnel)  
*complexity* (of the system)  
*controls* (over the systems life and within the system)

are not so obvious and provide additional insight into the users' perceptions of success.

#### *Relationship with organisational characteristics*

Analysis of the attributes can show how attributes work in different ways for particular organisations. A profile of the organisation's information system department strengths and weaknesses begins to emerge, viewed through the actual achieved success in the terms perceived by the users. Here lies the basis for remedial action which will allow the organisation to improve its overall success rate. For example:

- a low score in *direction* indicates a need for clearer strategies for IS and business management;
- a low score in *friendliness* suggests that ease of use needs to be a greater feature of the design stage;
- a low score in *necessity* suggests that the IT department is spending the company's money pursuing their own pet projects.

#### *Possible problems and precautions taken*

##### *Definitions*

An area of concern that was identified prior to the study is the extensive use of jargon within the information system industry. Differences in the interpretation of a single word can occur between organisations, and even between departments within a single organisation. In order to eliminate the potential for error that might arise from these semantic problems, a selection of the interviewees (seven of the original ten) were asked to verify attribute names, definitions of terms, and the source statements from which they were derived.

| Table 3: Illustration of Attributes, definitions and source statements |                                                                                                     |                                                                                                                                                                          |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Attribute                                                              | Definition                                                                                          | Source statements                                                                                                                                                        |
| 14 <i>Reliability</i>                                                  | The system or personnel have the ability to perform the promised service dependably and accurately. | <ul style="list-style-type: none"><li>- The system experienced few periods of downtime</li><li>- System data reliable</li><li>- System developers are reliable</li></ul> |
| 15 <i>Reporting</i>                                                    | The degree to which reports produced by the system (if any) are obtainable, accurate and useful.    | <ul style="list-style-type: none"><li>- Operational reporting provided</li><li>- Management reporting provided</li></ul>                                                 |

The way in which attributes were defined, and the sort of source statement from which they were derived, is illustrated in Table 3. All were dealt with at about this level; at this stage there were 21 attributes and 64 source statements<sup>4</sup>.

### *Differences in respondents and systems*

During the study it was noted that there are a number of other factors that might have an impact on the type of attributes influencing a user, for example the level of seniority of the interviewee within the organisation, the maturity of the system, and the strategic significance of the system<sup>5</sup>.

- Unlike the senior representatives, those lower down the organisation seemed to be less influenced by global factors such as *business alignment* and *integration* (of systems).
- Equally, the maturity (age) of the information system has an impact on the perception of the system; *upkeep* as an attribute becomes more important the older a system gets.
- Finally, it would appear that interviewees have similar perceptions about systems that share certain business significance, scope and characteristics, as defined by McFarlan's (1984) Strategic Grid. For instance one might anticipate that the attributes affecting users of "strategic" information systems would differ from those of users of "key operational" information system (Edwards, Ward and Bytheway, 1991).

### *An illustration*

To understand the implications of these findings on current systems practice, surveys were conducted in two large companies which were both undertaking major system developments.

Company A is a large provider of electronic information to the financial services industry. Millions of pounds in many currencies are traded weekly across the world, based on the information supplied. Competition in the market to sell these services is fierce and consequently a lot of emphasis and expenditure is focused on sales and marketing. Company A survives by being a good all-round operator rather than specialisation, and their systems are noted for being reliable. Customers are provided with on-site support within the hour, twenty-four hours a day. Company A was about to replace their order processing, product ordering, billing and financial systems with a single integrated system.

The survey in Company A revealed the following service attributes as key to user perceptions of success:

*Marketing*  
*Effectiveness*  
*Reliability*  
*Reporting*  
*Friendliness*  
*Business Alignment*

Company B is a large supplier of hospital equipment. Although the company is not state-owned it has for many years enjoyed a monopolistic relationship with the health service in the regions where it operates. Such was its close relationship with the national health service that many of its customers

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<sup>4</sup> These numbers changed slightly in later stages of the work, as attributes were rejected and augmented by the controls built into the design of the later work.

<sup>5</sup> Data was collected to deal with these variations and the precise influence of these additional factors will be reported in subsequent papers.

(doctors, nurses and administrators) believed it was part of the NHS. Hospitals ordered equipment by accessing Company B's system directly, from their own workstations. Company B was also about to replace its ordering, stock control, billing and financial systems with an integrated system.

The survey in Company B revealed the following service attributes as those most important to user perceptions of success:

*Responsiveness*  
*Flexibility*  
*Reliability*  
*Effectiveness*  
*Competence*  
*Business Alignment*

Traditional approaches to information system development would almost certainly provide technically excellent solutions. However, unless certain key service attributes are addressed, being particular to each company and its situation, there is a high probability that each of the information system offerings would be perceived by the users as being a failure.

- *In Company A the new system which was introduced was perceived to be a success even though in technical terms it delivered well below what was expected. The reason for its perceived success can be seen in a review of key service attributes for Company A.*

The new system was very well *marketed*, all information circulated through the organisation on the system was tightly *controlled*. The *effectiveness* of the system was only just acceptable: in other words, it offered very few additional technical features over its predecessor. The system was, *unlike* its predecessor, very *reliable*. The new systems *reporting* was perceived to be good, its level of *friendliness* acceptable. (it was replacing a system which was very unfriendly) and its *alignment* with the business was also perceived as good.

- *In Company B users perceived the new system to be something of a disaster. Technically the system appeared inadequately specified and was consequently delivered late and over budget. Again a review of Company B's key service attributes suggests there are deeper service problems which the company may not reasonably be able to address given the technical constraints of the system.*

Users in Company B regard the need for *responsiveness* and *flexibility* to be of paramount importance because this is what their customers require from them. Specialist equipment is often required by hospitals at short notice. The previous systems allowed these rushed orders to be turned around in a matter of hours and the paperwork sorted out subsequently. The new system proved *un-responsive* to these types of requests and proved *inflexible* in allowing its procedures to be circumvented. Their questions regarding the *competence* of systems staff given that the hardware platform had to be upgraded twice in the first twelve months of operation due to undersizing. Users and customers felt that the system were not *aligned* to the objectives of the business and was consequently putting the business and patients lives at risk.

## CONCLUSIONS AND FURTHER WORK

We see from this research that one can not afford to make simple assumptions about the nature of success in the use of information systems. It is a multi-dimensional problem and incorporates a wide range of concepts and ideas. It follows that a methodical approach is needed to the elicitation and formulation of our understanding of what success is in different situations. The work reported here provides just this.

### Summary of results

This study set out to identify those attributes that most influence users' perceptions of the success of information systems. The results have identified a set of twenty-one factors, described here as service attributes, which have been shown to be closely correlated with perceptions of information system success.

This list of twenty-one attributes can be compared with the attributes identified in previous research. Zeithaml *et al* (1990): *competence, reliability, responsiveness and empathy* (understanding). Baroudi *et al* (1986): *user involvement*. Rivard and Huff (1988): *friendliness of software, satisfaction with the support* from the information system department, and the standard of *maintenance*. At least 19 of the 36 scales (attributes) for measuring user information satisfaction proposed by Ives *et al*, (1983) are represented by attributes from this study. Table 4 presents an overview of this comparison with the results of previous work from Zeithaml, Ives and others. (Zeithaml *et al* (1990), Barley & Pearson (1983), Miller & Doyle (1987), Ives *et al*, (1983)).

**Table 4: Attributes compared to results of some other work**

| Attributes from this study | Attributes from other studies |                         |                       |                            |
|----------------------------|-------------------------------|-------------------------|-----------------------|----------------------------|
|                            | Zeithaml <i>et al</i> (1990)  | Barley & Pearson (1983) | Miller & Doyle (1987) | Ives <i>et al</i> , (1983) |
| Accuracy                   |                               | ✓                       | ✓                     | ✓                          |
| Business Alignment         |                               | ✓                       | ✓                     | ✓                          |
| Competence                 | ✓                             | ✓                       | ✓                     | ✓                          |
| Complexity                 |                               |                         | ✓                     |                            |
| Direction                  |                               |                         |                       |                            |
| Documentation              |                               | ✓                       |                       | ✓                          |
| Effectiveness              |                               | ✓                       |                       | ✓                          |
| Friendliness               |                               |                         |                       |                            |
| Front Office               |                               |                         |                       |                            |
| Integration                |                               | ✓                       |                       | ✓                          |
| Marketing                  |                               |                         |                       |                            |
| Necessity                  |                               |                         |                       |                            |
| Control                    |                               | ✓                       | ✓                     | ✓                          |
| Reliability                | ✓                             | ✓                       | ✓                     | ✓                          |
| Reporting                  |                               | ✓                       | ✓                     | ✓                          |
| Responsiveness             | ✓                             | ✓                       | ✓                     | ✓                          |
| Specification              |                               |                         |                       |                            |
| Training                   |                               | ✓                       | ✓                     | ✓                          |
| Understanding              | ✓                             |                         |                       |                            |
| Upkeep                     |                               | ✓                       | ✓                     | ✓                          |
| User Involvement           |                               | ✓                       | ✓                     | ✓                          |

### *A basis for action*

As indicated at the start of this paper, there are different viewpoints which are likely to be adopted by different players in the overall information systems business. This work will be of interest to all of them and it is helpful, because it gives a clear indication of what must be understood in order to improve things. By providing a quantitative foundation for assessing the state of things, the new framework provides a sound and more complete basis for benchmarking information systems success, and it can be used whether work is being done in-house or by the use of contractors.

- Software and systems houses who work for different client companies can, if they understand what success means to those companies, adapt their approach and support rather than impose upon the client business. It is not necessary to make assumptions about what is expected, because it can now be analysed leading to a more complete understanding of what factors might be important.
- Within a large commercial organisation, the central information systems department (if there is one) can more easily recognise the differences in need and expectation around the organisation, and react accordingly. If it is negotiating outsourcing arrangements then there is the prospect of building measures into the contract which will set service levels relevant to users, and provide a means of monitoring them.
- In the more typical case of a medium sized organisation wishing to initiate a programme of quality improvement, such a programme can be put into place, targets can be set, and the results achieved can be measured and communicated with users.

The information systems function has a reputation for consistent failure in many organisations. By paying some attention to service issues, such as making sure that users are not merely involved but that they understand what is being done for them, information systems departments could avoid major systems disasters at little real cost, and with potentially enormous benefits.

Using the assessment framework presented here, a business can be drawn into a discussion of information systems service delivery performance and how to measure it. The whole organisation can set about turning around the profiles of its systems, from perceived failure to perceived success. This will of course change the perception of the information system department by those who depend upon it. An information system department that can deliver systems that meet the expectations of the users will not only be seen as successful, but will be seen to be making a real contribution to the business.

### *Further work*

The next stage in this research is to apply the list of service attributes across a wider range of organisations to identify whether the service attributes can be applied to any organisation and whether the list is subject to variance. The influence of factors such as organisational type, the user's seniority within the organisation and the scope and maturity of information systems also have to be assessed. An instrument has been developed to conduct this research and interviews with target companies have commenced<sup>6</sup>.

This work has addressed problems with information systems in business by taking advantage of thinking in a different discipline: Service Operations Management. There is the possibility to extend this idea by appealing to other disciplines, such as operations management, strategic management and human resource management.

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<sup>6</sup> Since the preparation of this paper, this work has progressed well and is largely complete.

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