G. Doukidis, B. Galliers, T. Jelassi, H. Krcmar and F. Land, (Eds.)
Proceedings of the 3rd European Conference on Information Systems, Athens/Greece, June 1-3 1995

INFORMATION SYSTEMS 'FAILURE' AND RISK ASSESMENT: THE CASE OF THE LONDON AMBULANCE SERVICE COMPUTER AIDED DESPATCH SYSTEM

Paul BEYNON-DAVIS

Computer Studies Department
University of Glamorgan Pontypridd
Mid-Glamorgan CF37 1DL Wales, United Kingdom
E-mail: PBDAVIES@GLAM.AC.UK

Abstract

A number of frameworks have been proposed for understanding the concept of Information systems failure. In this paper we present a description of probably the most prominent case of information systems failure within the UK in recent times: The London Ambulance Service's Computer Aided Despatch System. Our main empirical aim is to illustrate the importance of 'web' explanations of information systems failure. Our main theoretical aim is to test the power of a number of proposed frameworks which seek to address the nature of information systems failure. We conclude with a discussion of the relationship between information systems failure and risk assesment.

1. Introduction

On the 27th of October 1992 an information system made the lead story on the BBC's Nine-O-Clock news. It was reported that a new computerised system established at the headquarters of the London Ambulance Service (LAS) (The London Ambulance Service's Computer Aided Despatch System - hereafter referred to as the LASCAD system) failed, and that as a direct result of this failure the lives of twenty to thirty people may have been lost.

In this paper we seek to use the case of the LASCAD project as an effective example of the multi-faceted nature of information systems failure. The paper has two main aims. Our main empirical aim is to illustrate the importance of 'web' explanations of information systems failure. Our main theoretical aim is to test the explanatory power of a number of frameworks purporting to adress the nature of information systems failure. In particular, we discuss a framework recently proposed by Sauer (1993) in the context of the LASCAD project. Our description of this case is primarily based on a collection of documentary material published during and after the critical events of the 26th and 27th October 1992, particularly the report of the public inquiry (Page et al, 1993). The description is also based on a limited number of informal discussions with persons involved in the LASCAD project, who, for a number of reasons, wish to remain anonymous.

1.1. Empirical Aim

Benbasat et al (1987) discuss the applicability of case study research to those types of problems where research and theory are at their early, formative stages. Case study research is particularly good at answering 'how' and 'why' questions: how a failure has occurred and why it happened. By studying problems in their natural settings case research allows us to understand something of the complexity of organisational processes.

In the context of this paper, case study research is committed to explaining information systems failure in terms of the complex intertwining of relationships in the context of computing. Sauer (1993) refers to this as a web model of explanation. Web explanations are necessarily complex. They do not offer a simple linear explanation of phenomenon. In this light, case histories are a valuable means of helping us understand the complexity of information systems development. They are particularly useful in engendering a more realistic view of information systems, replacing the romantic and simplistic idealism of textbooks with the hard reality of rich profiles.

In this paper we discuss one highly prominent example of a UK information systems project that many see as having 'failed'. Because of its prominence, some of the reasons for such a failure become more available to inspection than they would otherwise have been. The case is taken from the British National Health Service (NHS). This does not mean that this organisation is particularly susceptible to IS failures. The private sector probably experiences at least the same level of 'failures'. Many of the failures in the private sector are also of a degree of scale larger than that under consideration in the present paper (e.g., the London Stock Exchange's Taurus project (Computing, 1993c); the CONFIRM hotel reservations system in the US (Oz, 1994)).

1.2. Theoretical Aim

Our main theoretical aim is to test the explanatory power of a number of proposed frameworks that serve both to define the concept of information systems failure and in so doing relate the key components of IS failure. We shall particularly concentrate on an examination of a framework recently proposed by Sauer (1993).

1.3. Structure of the Paper

In section 2 we discuss a number of models of the concept of information systems failure. Section 3 introduces the LASCAD project. In section 4 we apply Saur's model in order to discuss the main features of the LASCAD project. Section 5 re-considers the concept of information systems failure in the light of this case study. Finally, section 6 discusses briefly the link between information systems failure and risk assessment in IS work.

2. Models of Information Systems Failure

Since the 1970s, a number of frameworks have been proposed for understanding the concept of Information systems failure. In this section we discuss the work of Lucas (1975), Bignell and Fortune (1984), Lyytinnen and Hirscheim (1987), and Sauer (1993).

2.1. Lucas

Lucas (1975) was one of the first researchers to study the concept of information systems failure. Lucas makes the important contention that '*the major reason most information systems have failed is that we have ignored organisational behaviour problems in the design and operation of computer-based information systems*'. He describes his model of failure as based on three classes of variables: user attitudes and perceptions, the use of systems and user

performance. He specifies his model in terms of a number of propositions linking these key variables:

> 'The policies of the information services department and the technical quality of systems are associated with favorable user attitudes and perceptions. Favourable attitudes and perceptions and systems with high technical quality are associated with high levels of use of information systems. Finally, low performance is associated with high levels of use for problem-finding information while the use of problem-solving information is positively associated with performance'.

Lucas describes a series of quantitative investigations used to verify his general hypotheses. Unfortunately, the data collected does little to illuminate the complex reality of organisational information systems - a reality which Lucas acknowledges in the following quote:

> 'We can easily see why there have been so many organisational behaviour problems in the design and operation of information systems. Consider the following scenario: First, the information services department ignores changes in user jobs and work relationships in designing new systems and implements systems in a highly authoritarian manner. The department ignores power transfers and the frustrations users may encounter with a foreign and poorly understood technology. Systems are operated in the same manner; users are blamed for errors and the information services department is unresponsive to requests for changes and does not follow schedules. Meantime, management does not influence information services department activities, but instead leaves its management to technical specialists. Management furnishes no leadership for users who judge that information systems are not important to the organisation.'

2.2. Bignell and Fortune

Bignell and Fortune (1984) broadened the analysis in considering the generic idea of failure from a systems perspective. They detail so-called failures in a number of diverse areas such as the Three Mile Island accident and the capsizing of the Alexander L. Kielland oil rig. Although their work does not consider information systems (IS) failures specifically, they do consider the general characteristics of all systems failures.

In their analysis a failure is said to occur when disappointment arises as a result of an assessment of an outcome from an activity. Failure can be a shortfall of performance below a standard, the generation of undesirable side-effects or the neglect of an opportunity. The assessment of an outcome as a failure is dependent upon the values held by the person making the judgement. These values affect how much of the performance of an activity is included for the assessment, what quantities or qualities are regarded as significant, and what standards are adopted. The standards are likely to vary from individual to individual, and group to group. They are likely to change with the time and the occasion of the judgement, and the viewpoint taken. Hence, from this viewpoint, failure will be found to be have multiple causes and to have multiple effects.

2.3. Lyytinnen and Hirscheim

Lyytinen and Hirscheim (1987) use some of the characteristics of failure discussed by Bignell and Fortune in surveying the literature specifically on IS failure. They identify four major categories of IS failure:

1. Correspondence Failure. This is the most common form of IS failure discussed in the literature and typically reflects a management perspective on failure. It is based on the idea that design objectives are first specified in detail. An evaluation is conducted of the information system in terms of these objectives. If there is a lack of correspondence between objectives and evaluation the IS is regarded as a failure.

2. Process Failure. This type of failure is characterised by unsatisfactory development performance. It usually refers to one of two types of failure. First, when the IS development process cannot produce a workable system. Second, the development process produces an IS but the project runs over budget in terms of cost, time etc.

3. Interaction Failure. Here, the emphasis shifts from a mismatch of requirements and system or poor development performance to a consideration of usage of a system. The argument is that if a system is heavily used it constitutes a success; if it is hardly ever used, or there are major problems involved in using a system then it constitutes a failure. Lucas clearly adheres to this idea of failure.

4. Expectation Failure. Lyytinen and Hirschheim descibe this as a superset of the three other types of failure. They also describe their idea of expectation failure to be a more encompassing, politically and pluralistically informed view of IS failure than the other forms. This is because they characterise correspondeace, process and interaction failure as having one major theme in common: the three notions of failure portray a highly rational image of IS development; each views an IS as mainly a neutral technical artifact (Klein and Hirscheim, 1987). In contrast, they define expectation failure as the inability of an IS to meet a specific stakeholder group's expectations. IS failures signify a gap between some existing situation and a desired situation for members of a particular stakeholder group. Stakeholders are any group of people who share a pool of values that define what the desirable features of an IS are, and how they should be obtained.

2.4. Sauer

Sauer (1993) has recently criticised the model proposed by Lyytinen and Hirschheim for its plurality. Sauers' model posits a conservative definition of information systems failure. According to his account a system should only be deemed a failure when development or operation ceases, leaving supporters dissatisfied with the extent to which the system has served their interests. This means that a system should not be considered a failure until all interest in progressing an IS project has ceased. This definition of *termination failure* is hence stricter than Lyytinen and Hirscheims' concept of *expectation failure* .

Sauer develops a model of information systems failure based on exchange relations. He portrays the development of information systems as an innovation process.based on three components: the project organisation, the information system, and its supporters. Each of these components is arranged in a triangle of dependencies (see fig.1.). The information system depends on the project organisation, the project organisation depends on its supporters, and the supporters depend on the information system. The information system requires the efforts and expertise of the project organisation to sustain it; the project organistion is heavily dependent on the provision of support in the form of material resources and help in coping with contingencies; supporters require benefits from the information system. However, the triangle is not a closed system. Contextual factors can affect the way in which each of the

dependencies are enacted. According to Sauer, the information systems context consists of six dimensions: cognitive limits, environment, technical process, structure, history and politics:

1. Cognitive Limits. For instance, limits of communication.

2. Technical Process. That is constraints arising from the nature of computer-based systems or the development process chosen. For instance the problems of developing and fixing an abstract specification of organisational processes, or of working within the constraints of a particular methodology

3. Environment. That is the constraints and contingencies enacted by customers, suppliers, ompetitors, regulators etc

4. Politics. That is the exercise of power in organisations.

5. Structure. Particularly internal project structure.

6. History. That is the existence of prior constraints and contingencies set up, for example, by previous information systems projects.

One of the key ways in which Sauer distinguishes termination failure from expectation failure is in terms of the concept of a flaw. Information systems are the product of a process which is open to flaws. Every information system is flawed in some way. However, flaws are different from failures. Flaws may be corrected within any innovation process at a cost, or accepted at a cost. Flaws describe the perception of stakeholders that they face undesired situations which constitute problems to be solved. Examples of flaws are program bugs, hardware performance, organisational changes etc. Unless there is support available to deal with flaws they will have the effect of reducing the capacity of some information system to serve its supporters and may result in introducing further flaws into the innovation process.

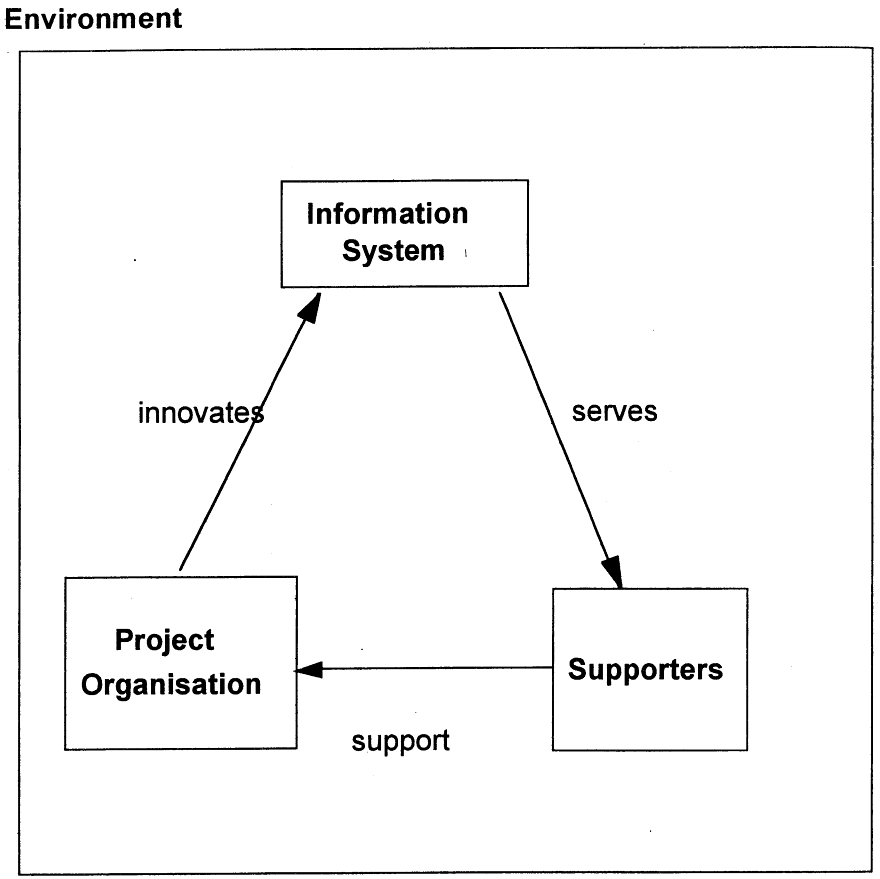
3. The LASCAD System

In this section we describe elements of Computer Aided Despatch systems, how the LASCAD system was intended to work, and reported details of the events described in the introduction.

3.1. Elements of a Computer Aided Despatch System

A Computer Aided Despatch (CAD) system for an ambulance service would normally expect to provide one or more of the following system functions (Page et al, 1993):

- Call Taking: acceptance of calls and verification of incident details incluing location.
- Resource Identification: identifying resources, particularly which ambulance to send to an incident.
- Resource Mobilisation: communicating details of an incident to the appropriate ambulance.
- Resource Management: primarily the positioning of suitably equipped and staffed vehicles to minimise response times.
- Management Information: collation of information used to assess performance and help in resource management and planning.



C.Sauer. Why Information Systems Fail:
A Case Study Approach. Alfred Waller. 1993

Fig. 1: Sauer's Model of IS Failure

Until quite recently most despatch systems were manual in nature. It is useful to understand some of the rationale for the LASCAD project if we briefly consider the workings of a manual despatch system. Such a manual system would ideal-typically consist of, amongst others, the following functions (Page et al, 1993)

1. Call Taking. Emergency calls are received by ambulance control. Control assistants write down details of incidents on pre-printed forms. The location of each incident is identified and the reference coordinates recorded on the forms. The forms are then placed on a conveyor belt system which transports all the forms to a central collection point.

2. Resource Identification. Other members of ambulance control collects forms, reviews details on forms, and on the basis of the information provided decides which resource allocator should deal with each incident. The resource allocator examines forms for his/her sector and compares the details against information recorded for each vehicle and decides which resource should be mobilised. The status information on these forms is updated regularly from information received via the radio operator. The resource is recorded on the original form which is passed on to a despatcher.

3. Resource mobilisation. The despatcher either telephones the nearest ambulance station or passes mobilisation instructions to the radio operator if an ambulance is already mobile.

Many UK ambulance services have now put some form of computerisation in place. Such systems particularly address the call-taking and resource identification functions described above. The major rationale expressed for such computerisation is typically that a number of problems are seen to exist with the manual CAD systems. Most such problems relate to the time-consuming and error-prone nature of activities such as: identification of the precise location of an incident; the physical movement of paper forms; maintaining up-to-date vehicle status information. A CAD system is seen by many within the ambulance service as a means of overcoming many of these problems, and particularly of improving the service to patients. In this light, one particularly contentious area of computerisation being approached by many ambulance services is the incorporation of so-called triage (despatch in terms of medical priority) systems into ambulance command and control.

3.2. How LASCAD was intended to work

The major objective of the LASCAD system was to automate many of the human-intensive functions described above. A diagram illustrating the essential features of the system is provided in fig.2. The basic functionality of the intended LASCAD system is described below:

- BT operators route all 999 calls concerning medical emergencies as a matter of routine to LAS headquarters (HQ) in Waterloo.
- 18 HQ 'receivers' were then expected to record on the system the name, telephone number and address of the caller, and the name, destination address and brief details of the patient.
- This information was then transmitted over a local area network to an 'allocator'. The system would pinpoint the patient's location on a map display of areas of London.

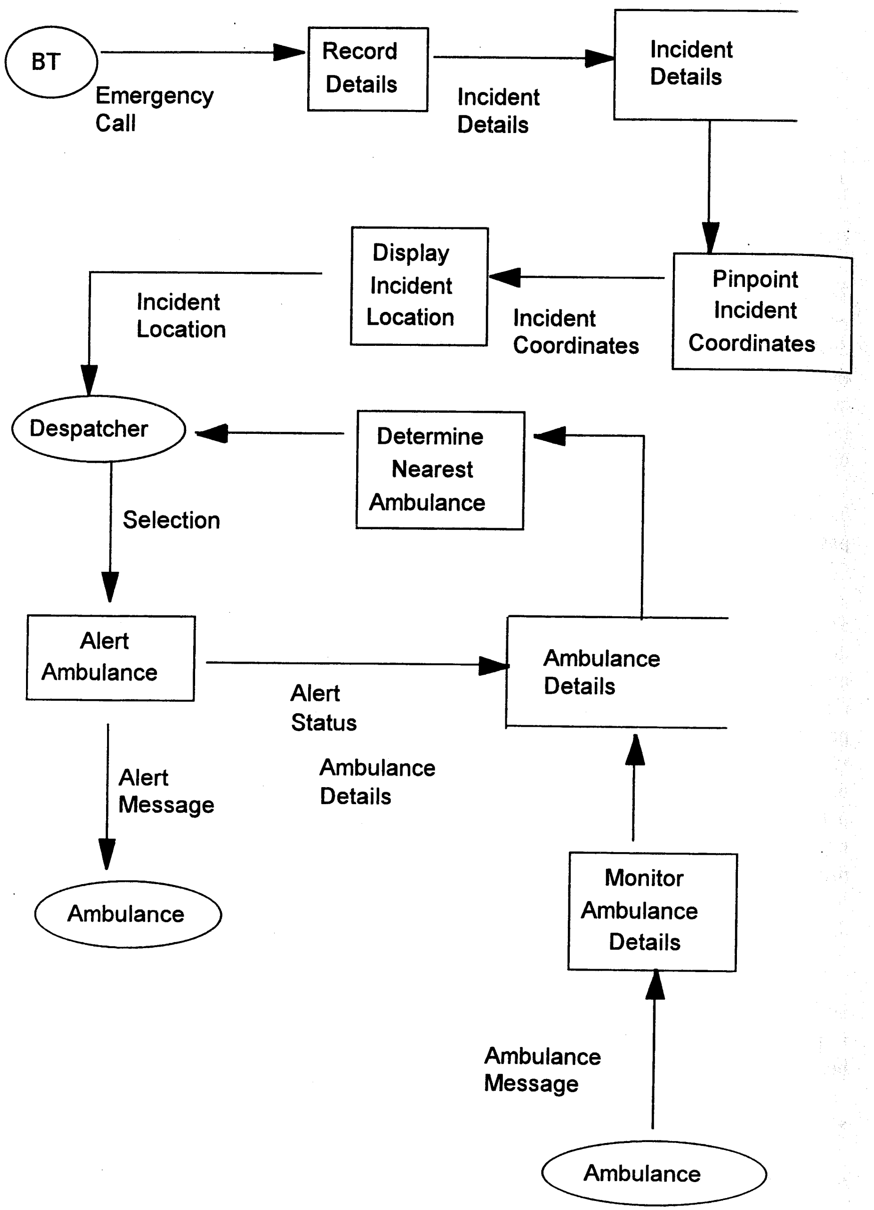


Fig. 2: How LASCAD was intended to work

- The system was expected to continuously monitor the location of every ambulance via radio messages transmitted by each vehicle every 13 seconds. The system would then determine the nearest ambulances to the patient.
- Experienced ambulance despatchers were organised into teams based on three zones (south, north-east and north-west). Ambulance despatchers would be offered details by the system of the three nearest ambulances and the estimated time each would need to reach the scene.
- The despatcher would choose an ambulance and send patient details to a small terminal screen located on the dashboard of the ambulance. The crew would then be expected to confirm that they were on their way.
- If the selected ambulance was in an ambulance depot then the despatch message would be received on the station printer.
- The ambulance crew would always be expected to acknowledge a message. The system would automatically alert the HQ of any ambulance where no acknowledgement was made. A follow-up message would then be sent from HQ.
- The system would detect from each vehicle's location messages if any ambulance was heading in the wrong direction. The system would then alert controllers.
- Further messages would tell HQ when the ambulance crew had arrived, when it was on its way to a hospital and when it was free again.

The LASCAD system was built as an event-based system using a rule-based approach in interaction with a geographical information system (GIS) (Daily Telegraph, 1992). The system was built by a small Aldershot-based software house called Systems Options using their own GIS software (WINGS) running under Microsoft Windows (Computer Weekly, 1992a). The GIS communicated with Datatrak's automatic vehicle tracking system. The system ran on a series of network PCs and file servers supplied by Apricot.

3.3. The Happening

On the night of Monday 26th October to the morning of Tuesday 27th October things started to go wrong at the HQ of LAS. It was reported that a flood of 999 calls (some 2900 instead of the usual 2300) apparently swamped operator's screens. It was also claimed that many recorded calls were being wiped off screens. This, in turn, caused a mass of automatic alerts to be generated indicating that calls to ambulances had not been acknowledged.

Claims were later made in the press that up to 20-30 people may have died as a result of ambulances arriving too late on the scene. Some ambulances were taking over three hours to answer a call. The government's recommended maximum is 17 minutes for inner-city areas (Guardian ,1992). A counter-claim was made that a breaking up of sector desks over the preceding weekend may have caused loss of local knowledge.

Arguably the LASCAD project was the most visible UK information systems failure in recent years. It is therefore not surprising to see that the happening described in section 2.3 triggered a whole series of responses. In many ways such responses seem reminiscent of a moral panic in information systems work (Cohen, 1980). This particular case seems to have been taken as indicative of a general malaise in software development projects. It has proven particularly effective as a focus for an ongoing debate on the professionalisation of information systems work. A number of other projects, such as the failure of the Taurus stock exchange system (Computing, 1993c), have also been used as material for this debate.

The LAS chief John Wilby resigned within a couple of the days of the events described above quoting as his reason the evident lack of confidence in the LAS (Times, 1992) (Guardian, 1992). Soon afterwards, a number of MPs called for a crack squad of IT experts to be set up to investigate IT in the NHS. The BCS President and Vice President claimed that the breakdown in the LASCAD system could have been avoided if computer people were trained to professional standards. President Roger Johnson stated that:

"The public are entitled to expect that the same professional disciplines apply in IT as in other professions such as medicine and law'. (Computer Weekly, 1992c).

Under pressure from such sources, the British Health Secretary, Virginia Bottomley, announced a Public Inquiry into the system headed by South Yorkshire ambulance chief Don Page. The findings of the inquiry were eventually published in an 80-page report in February 1993 (Page et al, 1993), which immediately became news in the UK computing (Computing, 1993a) and UK national press (Nine-O-Clock News, February 25th, 1993).

4. Sauer's Model Applied to Lascad

In this section we shall use Sauer's model as a means of organising key elements of our description of the LASCAD case. This is particularly useful in testing the explanatory power of Sauer's model of exchange relations in the context of the LASCAD project.

4.1. Project Organisation

It has now become something of an orthodoxy, or what Harel (Harel, 1980) calls a folk theorem, to assume that no information systems project can be understood in isolation from its context. As with any project of this nature, the LASCAD system was shaped by the prior history of IS innovation.

Firstly, it is interesting that, Systems Options, the company supplying the major part of the software for the system, is reported as having had no previous experience of building despatch systems for ambulance services. The company had won the £1.1 million contract for the system in June 1991. However, it appears that the London Ambulance Service had previously scrapped a BT subsiduary IAL development at a cost of £7.5 million in October 1990. This project is reported to have been late starting in May 1987 after a year's delay. The reason for scrapping this earlier project seems to have been centred around a debate over faulty software. The LAS sought damages from IAL for a faulty despatch module in October 1990 (Computing, 1993b).

Secondly, Systems Options substantially underbid an established supplier McDonnel-Douglas and were put under pressure to complete the system quickly. The managing director of a competing software house wrote a number of memoranda to LAS management in June and July 1991 describing the project as 'totally and fatally flawed' (Computing, 1992b). Another consultant described LAS's specifications as poor in leaving many areas undefined (Computer Weekly, 1992b).

In January 1992 phases one and two of the project began live trials. In March 1992, phase two of the trials were temporarily suspended following claims, particularly from the union NUPE, of fatal delays caused by system errors. In October 1992 phase three was terminated after two days of chaos.

A number of the findings of the public inquiry report (Page et al, 1993) directly relate to project organisation:

- First, it was claimed that the LAS chiefs ignored what amounted to an overambitious project timetable. The original procurement document, which was drafted within the guidelines provided by the regional health authority, put price before quality. A report by Anderson Consulting in late 1990 which called for more finance and longer timescales on the project was suppressed by project managers.
- Second, the LAS board were misled by the project team over the experience of Systems Options. The references supplied by Systems Options were not thoroughly investigated. Also, confusion seems to have arisen over who constituted the main contractor in the project. Systems Options, being an Apricot reseller, appear to have originally believed that Apricot would lead the contract.
- Third, that the management of the project was inadequate. The project team failed to use the PRINCE project management method as prescribed for public sector projects.
- Fourth, the software was incomplete and unstable. In particular, the emergency backup system remained untested. Questions were also raised about the choice of Visual Basic as a development tool and Microsoft Windows as the host operating system.
- Fifth, training in the use of the system was incomplete and inconsistent.

4.2. The Information System

It must be understood that LAS is unlike any other ambulance service in the UK. The service receives ten times as many emergency calls as any other ambulance service in the country. The organisation covers a geographical area of just over 600 square miles and handles emergencies for an area with a resident population of 6.8 million people.

Questions were also raised about the complexity of the technical system. A typical ambulance despatch system, like the ones employed in Surrey, West Yorkshire or Berkshire, merely acts as a repository of details about incidents. Communication between HQ and ambulances is conducted via telephone or voice radio links (Financial Times, 1992b). In the LASCAD system, links between communication, logging and despatching via a GIS were meant to be automated.

It is therefore tempting to adopt a stance of explaining this 'failure' purely in terms of problems of a technical nature. However, the report of the public inquiry (Page et al, 1993) portrays a more complex picture of the so-called technical problems experienced by the LASCAD system than that reported either in the computing or general press. It is interesting that they conclude:

"On 26th and 27th October the computer system did not fail in a technical sense. Response times did on occasions become unacceptable, but overall the system did what it had been designed to do. "

Discussions with a number of people has revealed a range of opinions about this important statement. However, it we take the statement at face value it does beg the question of what did happen to the system to cause response times to become unacceptable?

According to the report of the public inquiry, when the system was fully implemented at 07:00 on 26th October 1992 the system was lightly loaded. This meant that staff could cope with various problems associated with the communication system: eg., ambulance crews pressing wrong buttons; ambulances being in radio blackspots; 'hand-shaking' problems. As the number of incidents increased, incorrect vehicle location or status information received by the system increased. This increase in status errors meant that:

- The system made incorrect allocations - multiple vehicles were sent to the same incident, or the closest vehicle was not chosen for despatch.
- The system had fewer ambulance resources to allocate.

- The system placed calls that had not gone through the appropriate protocol on a waiting list.
- The system generated exception messages for those incidents it had recieved incorrect status information.

These effects compounded the situation. For instance, the number of exception messages increased rapidly to such an extent that staff were not able to clear the queue. The increasing size of the queue slowed the system. With the increasing number of 'awaiting attention' and exception messages it became increasingly difficult to attend to messages that had scrolled off the screen.

With fewer resources to allocate, and the problems of dealing with the waiting and exception queues it took longer to allocate resources to incidents.

At the ambulance end, crews became increasingly frustrated at incorrect allocations. The inquiry believes that this may have led to an increased number of instances where crews didn't press the right status buttons, or took a different vehicle to an incident than that suggested by the system. The system was therefore in a vicious circle of cause and effect.

4.3. The Supporters

Sauer's use of the term supporter is clearly meant to highlight the importance that some organisational group has in providing resources, physical or otherwise, which support the innovation process. However, not all groups are natural supporters of innovation. We prefer the use of the more general term stakeholder (Land, 1976) in the sense that not all groups with an interest in the development of an information system necessarily support that development. Some stakeholder groups may have a definite negative interest in the success of a given project. Three major stakeholder groups are relevant to our analysis of the LASCAD project: LAS management, headquarters staff (particularly those in the control room) and ambulance staff. There is clear evidence of a mismatch of perspectives between each of these groups. Only the first of these groups was a natural supporter in Sauer's sense of the term.

The system has been described as being introduced in an atmosphere of mistrust by staff. There was incomplete 'ownership' of the system by the majority of its users. The many problems experienced with various system components in the preceding months had instilled an atmosphere of mistrust.

Hardware and software suppliers dealing with the London ambulance service have spoken of disorganisation, low staff morale, friction between management and the workforce, and an atmosphere of hostility towards computing systems. An ambulance crew member is reported as saying, 'whatever system you have people have to have confidence in it. We want to go back to the simple system, telephone and radio. Anybody can use it. Crews have confidence in it.' (Financial Times, 1992a). One of the reasons for this low staff morale may be that control room staff had virtually no previous experience of using computers (New Scientist, 1992a). The union NUPE continually made aspersions to what they considered a 'macho' style of management at LAS. The Labour party's health spokesman, David Blunkett demanded a public inquiry into the system in September 1992, a month before the events described above, after receiving a report from NUPE (Computing, 1992a).

4.4. Contextual Factors

The political and economic environment within which the LASCAD project took place is probably the most important contextual factor in this case. The environment of the LASCAD

project can be considered in the macro sense of the constraints imposed by the overarching organisation of the British National Health Service (NHS) and in the micro sense in terms of the labour relations history at the LAS.

The political and economic context of the NHS has clearly influenced the current shape of the organisation's computing, including most of the information systems projects conducted within the remit of the organisation (Beynon-Davies, 1994a). Indeed, the LASCAD system is only one example of supposed systems failure within the NHS.

Firstly, it must be understood that there is no demonstrable and unitary power-structure within the NHS. The NHS is a body made up of a complex network of autonomous and semi-autonomous groups concerned with health matters. Actual delivery of health care is in the hands of powerful clinical professionals who are naturally concerned with preserving their professional autonomy (Leavitt and Wall, 1992).

One consequence of this is that any project carried out in the NHS, such as LASCAD, has to consider what relationships in the network are affected by the project and what activities have to be undertaken to enable or encourage those relationships (Checkland and Scholes, 1990). For instance, in a related paper we have discussed some of the constraints this enabling network has placed upon information management in the NHS (Beynon-Davies, 1994a).

Computing within the NHS is therefore complicated by the fact that no one body has overall responsibility for information technology (IT). IT is exploited and controlled at a number of different levels: region, district, hospital, department, specialty and general practice. Each stakeholder has a different perception of IT. Region and district tend to emphasise administrative systems. Hospital and GP surgery emphasise clinical applications. Region emphasises management information. District emphasises operational systems.

The lack of a clear organisation for IT has meant the absence of a clear strategic vision for IT. To build a strategy there must be first some agreement on objectives. Clearly, many of the objectives of the various stakeholders are in conflict. This situation is unlikely to change with the recent moves towards a market of providers and purchasers in the NHS.

A great deal of the shape of the LASCAD project was determined by the internal tensions within the NHS. For example, members of the public inquiry (Page et al, 1993) reflect on some of the stresses and strains that have been placed on the LAS by changes in the NHS over the last few years.

> "Under the NHS reforms, all parts of the NHS have gone through major cultural changes in the past few years and it is evident that the LAS could not bury its head in the sand if it was to provide a professional and successful service in the 1990s.
> However, the result of the initiatives undertaken by management from 1990-1992 did not revitalise management and staff as intended, but actually worsened what was already a climate of mistrust and obstructiveness. It was not a case of management getting the agenda wrong. The size of the programme and the speed and depth of change were simply too aggressive for the circumstances. Management clearly underestimated the difficulties involved in changing the deeply ingrained culture of LAS and misjudged the industrial relations climate so that staff were alienated to the changes rather than brought on board"

It is misleading to portray the management problems of the LAS purely in the context of the two years prior to the events of 1992. Many of the pressures on the LASCAD project can be seen to be the result of a protracted climate of conflict in the ambulance service between management, unions and the government of the day. The Public Inquiry maintains that during the 1980s there was clear evidence that management failed to modernise the service. This was reflected in a lack of investment in the workforce (such as paramedic training and career advancement), the fleet and the estate. By the end of 1990. at the end of a protracted national dispute over pay, the LAS stood in need of major modification and change. During the period between January and April 1991 the number of senior and middle-management post within the LAS was reduced from 268 to 53. There appears to have been little consultation with staff over the restructuring and the whole process caused a great deal of anxiety in the organisation.

Therefore, the public inquiry (Page et al. 1993) cite an important reason for the unstable industrial relations climate within LAS as the 'fear of failure' on the part of management. Changes in structure created a climate in which management were continually under pressure to succeed. This may have put undue pressure on management to ensure that the LASCAD system was implemented on time and within budget. However, it may also have blinded them to some of the fundamental difficulties of the system implementation.

The inquiry team believe that most of the operational management at LAS were of the opinion that LASCAD would act as an essential means of overcoming what they saw as outmoded practices. Such practices included the ability of crews themselves or the ambulance stations to decide which resource to mobilise in response to an incident. These practices were to be replaced with what management saw as a system which would decide in an objective and impartial way the optimum mobilisation of resource.

The inquiry team make the comment that management were naive in assuming that the simple introduction of a computer system would automatically result in changes in working practices. Crews and stations. if they wished. could still accommodate older practices by employing strategies such as failing to mobilise. sending a different resource, or failing to acknowledge or report status.

5. Information Systems 'Failure' Reconsidered

Clearly, it is impossible to point to any one element of the description above as being <u>the cause</u> of the LASCAD failure. The description hopefully demonstrates how the explanation of a particular information systems failure must be multi-faceted or web-like in nature. Mackenzie's (1994) recently published analysis of computer-related accidents reported in the ACM's Software Engineering Notes seems to support this conclusion. He found that of the cases reported to the journal 92% involved failures of technical interaction with cognitive/organisational factors.

It is interesting. of course. that there is even some debate about whether the LASCAD case even constitutes a failure. The LASCAD project is a clear example of the concept of expectation failure (Lyytinen and Hirscheim. 1987). The system does not appear to have 'failed' in the strict technical sense. but did fail to meet the expectations of many of the stakeholder groups involved in the project. However. using Sauers' model, the LASCAD project would not be deemed an example of termination failure.

At the time of writing the LASCAD project organisation has been re-structured but has not lost the support of the major stakeholders. the LAS, South West RHA and the NHS. The new head of IT at LAS is reported as having until August 1997, with a provisional budget of £13.5M. to deliver a CAD system for LAS (Computer Weekly, 1994). The first stage of the work. a system for call-logging. call transfer. address-finding and vehicle location is reported as reaching completion in April 1995 (Computer Weekly, 1995).

In this sense. the 'breakdown' of the LASCAD system on the 26th/27th October 1992 would be taken to be the result of a number of system flaws that are currently undergoing rectification.

In other words. the triangle of dependencies in this project has not broken down. Although support from stakeholders like LAS HQ staff and ambulance service staff may have

been seriously dented by events, support from stakeholders such as LAS management and SWRHA is still there. The project team still has the remit to develop the information system for HQ staff, albeit over a longer timescale. This is perhaps not suprising in the sense that many of the problems that LASCAD was meant to address appear to be still present within the organisation. For instance, in January 1995 an inquiry into the death of a child in London laid at least part of the blame on an inexcusable delay by the LAS apparently caused by a 'failure' in the manual despatch systems (Guardian, 1995).

6. Risk Assessment and Information Systems Failure

Perhaps because of the apparent ubiquity of IS failure, the area of risk and risk assessment has become particularly prominent in the software engineering literature in recent times (Boehm, 1989). The folk theorem here (Harel, 1980) is clearly that risk is involved in all IS projects. Risk might be defined as a negative outcome that has a known or estimated probability of occurring based on some experience or theory. The idea of IS failure is clearly the negative outcome most prominent in most people's minds. However, our analysis above clearly supports the viewpoint expressed by Wilcocks and Margetts (1994) that:

> 'Risk of a negative outcome only becomes a salient problem when the outcome is relevant to stakeholder concerns and interests. Different settings and stakeholders will see different outcomes as salient'.

Risk assessment is clearly the process involved in estimating the degree of risk associated with a given project, usually at the feasibility stage of development. A number of frameworks have been generated which suggest a number of characteristics indicative of risky IT projects. For instance, Cash et al (1992) suggest that there are at least three important dimensions that influence the risk of a project: project size, experience with the technology and project structure. In general, the smaller, more experienced and more highly structured the project the less risk is likely to be associated with it.

However, a web model of IS failure such as the one discussed in this paper has difficulty in melding with a risk assessment framework such as Cash et als' which ignores context, history and organisational processes. A 'failure' framework such as Sauer's has more in common with a recent risk assessment framework proposed by Wilcocks and Margetts. In this approach, six interplaying categories are brought into analysing the development, introduction and use of information systems:

- History. Prior organisational developments.Eg., prior IS success/failure.
- Outer Context. The givens that an organisation and its members need to respond to and accommodate. Eg., government, the economy, markets etc.
- Inner Context. The characteristics of the organisation itself. Eg., strategy, structure, reward systems.
- Content. The changes involved in and substance of a project. Eg., size of project, difficulty.
- Processes. How things are done and the issues perceived. Eg., project management, staffing etc.
- Outcomes. Planned or unanticipated. Eg., Cost, time etc.

There are clear links here between Sauer's triangle of information system, project organisation and supporters working within a historical context and environment and Wilcocks and Margetts collection of interplaying factors.

7. Conclusion

In this paper, we have presented a case history of a prominent information systems project which many people report as a failure. Case histories of this nature are a valuable means of helping us to understand the complexity of information systems development (Benbasat et al, 1987). They are particularly useful in engendering a more realistic view of information systems, replacing the romantic and simplistic idealism of much of the textbook literature with the complexity and richness of hard reality.

Frameworks such as Lyytinnen and Hirscheim's and Sauer's are particularly useful in highlighting the political, economic and social nature of information systems failure. Lyytinnen and Hirscheim's concept of expectation failure clearly locates the idea of systems failure in the area of human interpretation. Sauer's framework is useful in proposing that it is only when relationships between crucial elements of an information systems project break down irretrievably can the project be said to have failed.

Recent work seems to support the hypothesis that the larger the information systems project the more risks there are of the project failing in Sauer's sense of the term (Wilcocks and Griffiths, 1994). Amongst other reasons we might expect this to be the case because of the larger number of stakeholder groups involved in such projects. We might hypothesise that one of the reasons why LASCAD is not an example of termination failure while other projects such as the London Stock Exchange's TAURUS project (Waters, 1993) clearly has something to do with the greater likelihood of exchange dependencies breaking down in large-scale projects.

8. References

1. Avison D.E. and Wood-Harper A.T.: *Multiview: an exploration in information systems development.* Blackwell Scientific, Oxford, (1990).
2. Benbasat I., Goldstein D.K., Mead M.: The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*. Sept., (1987).
3. Beynon-Davies P.: The Behaviour of Systems Analysts. *Computer Bulletin*. March, (1990), pp 21-23.
4. Beynon-Davies P.: *Information Systems Development: an introduction to information systems engineering.* Second Edition. MacMillan, (1993).
5. Beynon-Davies P.: Information Management in the British National Health Service: The Pragmatics of Strategic Data Planning. *International Journal of Information Management.* 14(2). April, (1994a),. 84-94.
6. Beynon-Davies P.: The London Ambulance Service's Computer Aided Despatch System: A Case Study in Information Systems Failure. *Dept. of Computer Studies Technical Report.* University of Glamorgan, (1994b).
7. Boehm B.W.: Ed. *Software Risk Management.* IEEE Press, (1989),
8. Checkland P.: *Systems Thinking, Systems Practice.* John Wiley, Chichester, (1987).
9. Checkland P.: and Scholes J. An Application of Soft Systems Methodology in the NHS. In *Soft Systems Methodology in Action.* John Wiley, Chichester, (1990).
10. Cohen S. Folk Devils and Moral Panics: *the creation of the mods and rockers.* (New Ed.). Martin Robertson, London, (1980).
11. Labour calls for inquiry into ambulance system.: *Computing,* Sept. 4, p. 5, (1992a).
12. LAS bosses ignored warnings.; *Computing,* Nov. 5, (1992b), p. 1.
13. Leader.: *Computing,* March 4, (1993a), p.15.
14. City seeks redress for Taurus.: *Computing,* March 18, (1993e), p. 1.

15. Ambulance revert to paper-based backup.: *Computer Weekly,* Nov. 5, (1992a), p.6.
16. LAS system to stay down until February.: *Computer Weekly,* Nov 12, p.4., (1992b).
17. BCS President blames training for 999 failure.: *Computer Weekly,* Nov. 19, (1992c).
18. Condition Critical. August 25th., *Computer Weekly,* (1994).
19. Ambulance System to Finally go Live in April.: *Computer Weekly,* January 9, (1995).
20. 'Flood of calls' caused 999 chaos.: *Daily Telegraph,* Oct. 29, (1992), p. 1.
21. Staff revert to trusted radio and telephones.: *Financial Times,* October 30, (1992a).
22. Dire effects of a failure to communicate: what caused the Ambulance Service computer system to crash?.: *London Financial Times,* October 30, (1992b), p. 1.
23. Ambulance Chief Resigns.: *Guardian,* 29th Nov., (1992), pp. 1-2.
24. Ambulance Service needs Extra £3M a Year.: *Guardian January,* 9, (1995).
25. Harel D. On Folk Theorems.: *CACM.* 23(7),(1980), 379-389.
26. Klein H.K. and Hirscheim R.A. (1987). A Comparative Framework of Data Modelling Paradigms and Approaches.: *The Computer Journal,* 30(1). 8-14.
27. Land F. (1976). Evaluation of Systems Goals in Determining a Design Strategy for a Computer-Based Information System.: *Computer Journal,* 19 (4). 290-294.
28. Leavitt R. and Wall A.: *The Reorganised National Health Service* (4th Ed.).: Chapman and Hall, London, (1992).
29. Lyytinen K. and Hirscheim R.: Information Systems Failures: a survey and classification of the empirical literature.: *Oxford Surveys in Information Technology.* Vol. 4, (1987) 257-309.
30. *London Ambulance Service Inquiry Team.*: Press Release: LAS Inquiry Team Report. 25th February 1993.
31. McKenzie D.: Computer-Related Accidental Death: an empirical exploration. *Science and Public Policy.* 21(4), 1994.
32. Mumford E.: *Designing Participatively:* Manchester Business School Press, Manchester, 1983.
33. Ambulance computer system was 'too complicated'.: *New Scientist,* Nov.14, 1992. p.7.
34. Oz E. (1994). When Professional Standards are Lax: the Confirm failure and its lessons. *CACM.* 37(10). 29-36.
35. Page D., Williams P., Boyd D.: *Report of the public inquiry into the London ambulance service.* South West RHA, 1993.
36. Skidmore S., Farmer R., Mills G. *SSADM Version 4 Models and Methods.* NCC Blackwell, Manchester, 1992.
37. South West Thames Regional Health Authority. Press Release: Response of South West Thames Regional Health Authority to the report of the team of inquiry into the London Ambulance Service, February 25, 1993.
38. South West Thames Regional Health Authority.: Revised accountability arrangements for the London ambulance service. Report to the Secretary of State for Health, (1993b)
39. Alfred Waller, Henley-On-Thames.: *Why Information Systems Fail: A Case Study Approach, 1993..*
40. Stamper R. and Kolkman M. (1991). Problem Articulation: A sharp-edged soft systems approach. *Journal of Applied Systems Analysis.* 18(1). 69-76.
41. Stamper R.: *Information Management.* Inaugural Address. University of Twente.
Times (1992). LAS ambulance chief quits over 999 scandal. Oct 29, 1989, p. 1.
42. R. Waters. The Plan that Fell to Earth. Financial Times., March. 12, 1993.
43. Wilcocks L. and Griffiths C. (1994). Management and Risk Issues in Large-scale IT Projects: A Comparative Analysis. *Oxford Institute of Information Management. Research Paper.*

44. Wilcocks L. and Margetts H.: Risk Assessment and Information Systems. *European Journal of Information Systems*. 3(2). 1994, pp. 127-138.

G.Doukidis, B. Galliers, T. Jelassi, H. Kremar and F. Land (Eds.)
Proceedings of the 3rd European Conference on Information Sytems, Athens Greece, June 1-3 1995

REGAINING CONTROL: THE CASE OF THE SPANISH AIR TRAFFIC CONTROL SYSTEM - SACTA

Arturo DE SALABERT

Erasmus University Rotterdam

Michael NEWMAN

Erasmus University Rotterdam &
Manchester University
United Kingdom

Abstract

In this idiographic case, we show how a group of Spanish Air Traffic Controllers (ATCs) deliberately and systematically exposed the weaknesses of a new, sophisticated digitised control system. In doing so, they focused management's attention and gained public awareness for the importance of their role in controlling the passage of aircraft. As a consequence they regained control over the task. An abstract rationally might claim that an information system (IS) which enhances the work practices of individuals and groups should be readily acceptable. However, when we substitute this with a political perspective, we can provide plausible explanations for the seemingly pathological behaviour of the ATCs. The paper closes with a discussion of the implications from the case.

1. Introduction

The puzzle of user resistance to introducing information systems into organisations continues to intrigue researchers across several continents [6, 11, 13, 17]. As well as the academic reasons for these studies, the scale of system failure makes the study of resistance even more compelling. Resistance to I.S. can be thought of as a subset of organisational change; anything that threatens the status quo in organisations is likely to be met with resistance from the perceived losers and only a tacit approval by those with the most to gain. This is old ground; Machiavelli [12] said much the same thing concerning the political status quo in mediaeval Italy.

In studies of organisational change, Mechanic [14] and Crozier [3] both acknowledged the power of relatively low-level workers who were effective in using (or abusing, depending on one's perspective) control over important organisational resources. In particular, Crozier [3] showed how a group o maintenance engineers frustrated the intentions of management by destroying machine maintenance manuals. Thus they were able to continue their control over scheduling repairs to the machines rather than allowing management to assume control over that function. While such behaviour may appear dysfunctional, pathological even, in an abstract sense, in a political framework it is entirely clear why they adopted their stance.

Discussions of power and politics have not been ignored by IS researchers [13, 15, 8, 16, etc.]. Markus (1983) for example, majors on the political variant of her interaction theory to explain why a group of divisional accountants resisted the imposition of an ill-fitting financial reporting system. While she acknowledges the importance of individual and technical issues of quality and match, Markus supports a more macro perspective. Thus, in this framework, centralised systems may work fit in organisations with a centralised decision authority structure but not in those with decentralised structures, as in the case she documents.