

An evaluation of case study methodology within information system research

Hugh Preston and Tim Hayward
Department of Information and Library Studies
University of Wales, Aberystwyth
hjp@aber.ac.uk

INTRODUCTION

This paper examines issues of rigour and relevance in IS research through an investigation of the validity of case study analysis as a methodology. In order to achieve this it looks at a fundamental issue in the study of information systems: do systems known to deliver accurate, relevant and timely information, actually lead to more effective decision making? The focus is on the applicability of a case study approach to distinguishing IS issues from other organisational factors and on the extent to which such a distinction is valid. The two cases studied are UK National Health Service Trusts. The paper targets the validity of such research into IS issues to establish this differentiation or to refute the existence of factors that are peculiar to IS but are in fact general organisational determinants. This will illustrate some characteristics of IS research and whether they are individual to the field.

The context of health service Trusts is one with which there is much familiarity in the IS community and a continual growth of research opportunities and benefits. The research on which this paper is based was designed to establish links between managers' use of information systems and their application of post-suppositional ("What if...?") decision making queries.

An aspect of the study that quickly became apparent was that the case study approach was revealing a much broader range of issues than initially anticipated. It was also establishing links and associations that fell outside the scope of the research project with its limited funding. The nature of case study investigation and analysis therefore became an important issue since the methodology was clearly determining the scope of the research and steering its findings. This was not, as you might expect, particularly surprising, but the project acquired an additional layer of methodology evaluation as well as the original analysis of an organisational decision making hypothesis.

The outcome of the project's original objectives and of the additional evaluation of a case study approach to IS research resulted in three elements reflected in this paper. These highlighted the role and value of the case study methodology as a means of researching:

- organisational issues;
- information system issues;
- the association of effective systems and effective management, or no association, i.e. the existence of an association of effective management with *other* organisational factor(s).

These elements of IS research are all aspects of the instances of case study research identified by Cavaye in a recent article (Cavaye, 1996). It is reflected in the conclusion that case research is sufficiently multi-faceted to be appropriate in investigating many issues from a range of epistemological standpoints, using various methods. It is not, therefore, prescriptive in any of these respects. The last of the three elements is also a reflection of Yin's 'rival propositions' (Yin, 1989). These propositions constitute an alternative angle on the more traditional approach of endorsing or denying the validity of a relationship through testing of a null hypothesis. Evaluations of case study methodologies by authors such as Yin and Stake (Stake, 1995) were revisited during the study in order to establish the extent to which the influence of case analysis is predictable. The positivist approach expounded by Yin clearly needed amending to take into account factors that were not easily quantifiable. Walsham's work in the interpretative area was also taken into account (Walsham, 1993).

In addressing the stated issues, there is no attempt to describe information system technology in detail, but rather to identify relationships between managers and systems through their needs in connection with the information that the systems are currently supplying. The interviews conducted with managers in each of the NHS Trusts focused on financial issues, primarily costing of services through contracts. This had been the subject of the original study. Consequently, quantitative information merges with the managers' understanding of the operational and general environments. This blend of data sources and types offers illustrative and sometimes contradictory evidence in asserting or denying the distinction between IS and miscellaneous organisational issues, i.e. the basis of the rival propositions. The research project in terms of its original function was a limited activity aiming to seed a larger scale and more representative investigation.

Data collection

The data collection took two forms:

- desk-based study of the Trusts using background literature, annual reports and financial accounts;
- interviews with the finance director and with the information systems manager in each of the two Trusts.

The aim of the interviews was to establish sources of information used by financial managers and the value that they attached to the information provided by the Trust's information systems. The systems managers provided detail about the systems themselves and an indication as to how non-financial information activity (e.g., patient-based) had a role in filling in the decision making environment. This was crucial to the project's focus on, "What if...?" decisions.

CASE STUDY METHODOLOGY AND APPLICATION

It has already been stated that the research project did not aim to investigate methodologies and their applicability. The choice of a case study approach was the result of a need to have a single focus (finance and costing) but a view of the broader environment. However, project funding meant that proportionately large samples of the NHS Trust population and statistical significance were not viable. This is, we believe, a frequent issue for IS researchers. This inevitably means that case study analysis runs the risk of being the fall-back methodology for under funded projects. It could also be accused of being imprecise since its broad scope and the potential absence of exact statistical measures can lead to vagueness. However, if it were not for case study approaches to organisational analysis, some unique and exceptional instances of organisational activity and behaviour would not have been identified and been made available to compare against assumed norms and accepted theories. The ability of a case study to examine an organisation in depth is also a justification for its use and. In surveying IS literature this is often the application that we find. To take a typical example drawn from a cursory browse of journal articles, Fuller-Love and Cooper, writing in the *International Journal of Information Management*, cite the disclosure of concealed as well as apparent organisational elements as being justification for a case study approach. The title of the article, *How information technology shapes strategy in the steel industry: a case study of British Steel*, is a clear guide to the role of the case being studied: a single case, a comprehensive analysis (Fuller-Lover & Cooper, 1994).

The cases in the study that is the subject of this paper have less certain roles. There are two of them and they are sufficiently different to prevent a composite case being generated. One is a rural Trust with a range of individual sites over a large geographical area. The other is a single site Trust in London. The obvious alternative to a composite role for them is a comparative role. The study was of information systems managing financial and cost related activities so one might assume that systems would need to be centralised to differing degrees and have

structures to reflect inconsistent use of contract types within the NHS internal market. However, this instance of two Trusts with different means of financial management and related information systems may, or may not be representative of differences between various factors. These include differences between: rural and urban Trusts, multi-site and single site Trusts, Trusts with many purchasing customers or with a single main purchaser, or simply differences between Trusts in general. Consequently, Yin's assertion that one justification for case study analysis is that it enables a unique case to be studied, probably has some validity in any research of the type that this study and many other IS studies constitute (Yin, 1989). Unless preliminary research of a large sample of Trusts had taken place and it could be statistically proven that the chosen Trusts were representative of particular types, it can only be assumed that each will have predominantly unique characteristics.

With the characteristics identified above, case study methodology is particularly useful to organisational analysis since it operates by identifying specific factors and influences. This is an alternative to recording activity without specifying individual factors and then applying statistical analysis to determine degrees of significance for the results, i.e. how likely is it that the findings are representative of all instances? The case study approach, by using carefully chosen and worded questions, is more like a classic scientific experiment in that environmental factors are limited in ways analogous to insulated walls, vacuum seals etc. (Campbell, D in foreword to Yin, 1989).

Yin asserts the overall validity of the case study methodology: Since single scientific experiments do not offer the ability to generalise about unknown factors, single case studies cannot be used to generalise. "...case studies, like experiments, are generalizable to theoretical propositions and not to populations or universes" (Yin, 1989). It may seem hard to reconcile the tangible components of information systems and organisations with, 'theoretical propositions' alone, but such conceptual elements often take a more substantial form.

This research project used a case-study approach from a point of view of expedience. Such an analysis made it possible to concentrate the research resources and to look in some depth at the problem of contract decision making in NHS Trusts. It may be argued that an alternative survey method would also suit the aims of the research in that it was attempting to establish manager's views and beliefs as well as to test a hypothesis. Such depth is difficult or expensive to achieve with a large scale survey. Given the short time-span of the project (5 weeks) it was felt that the case study approach represented the most appropriate method.

In addition, Yin argues, that there are some situations where a specific strategy has a distinct advantage. For the case study, this is when:

A 'how' or 'why' question is being asked about a contemporary set of events, over which the investigation has little or no control. (Yin, 1989: 20)

This indicates a clear difference between organisational research as a form of scientific experiment and as a study of human behaviour and attitudes. Campbell's insulated environment clearly cannot apply to the investigation of organisations and their information systems. The environment, predictable in its effects or not, must be taken into account. The main drawback would seem to be that although case-studies can be used to illustrate general points, they obviously lack the statistical validity of samples. Although care needs to be taken in the drawing of conclusions, it may be argued that it is better to have a few carefully managed case studies than to aim for large, generalised samples that may produce dubious results (Patton, 1990). The potential depth of a case study certainly suggests that more clues will be found for closer quantitative investigation, than a survey, however broad, based on a single questionnaire.

The research design also needed to consider whether to use multiple or single case designs. Multiple cases have distinct advantages and disadvantages. As Yin (Yin, 1989) notes, their evidence is often considered more compelling and the research is therefore considered more robust. However, the rationale for single case designs, rare and critical cases, cannot usually be satisfied by the multiple case design. As this project did not intend to focus on rare or unusual cases, a multiple case design was considered appropriate. As two cases were used, the research is comparative to the extent that the same questions were asked to related organisations. Yin (1989) points out that the purpose of data gathering in comparative cases is not to *sample* different organisations because you wish to generalise findings but to *replicate*. In other words, it is to compare the organisation with others in a systematic way.

THE CASE STUDY AS A MEANS OF IDENTIFYING DETERMINANTS OF EFFECTIVENESS IN DECISION MAKING.

The research project

The two groups of interviewees in the project - finance managers and the information system managers, naturally differed in their appreciation of environmental and systems issues. However, it was apparent that all interviewees were aware of a very much wider range of organisational determinants at the internal and external levels than the relatively narrow occupational focus of their work might suggest. An early suggestion to the researchers from the data was that a single or even multiple survey method would be unlikely to establish how broad this understanding of the Trust's position was.

Managers at both Trusts believed that the rationale behind contracting was to increase the quality and cost-effectiveness of their service. Although they were operating in the public sector, they considered the service as having to justify its market position. The nature of contracts with purchasers was understood in terms of the main three types: block contracts, cost & volume contracts and cost-per-case contracts.

As reflected in the literature, there had clearly been an initial emphasis on block contracts. Since then, Trust B mentioned that contracts were becoming more volume and quality sensitive. This reflects the views of commentators since the NHS review (Barwell & Spurgeon, 1993). The case study approach, by revealing that Trust B had been wholly block contract oriented to start with, offered an interpretation of the manager's statement that would have required a detailed survey questionnaire to match it. The logical conclusion of the move to more flexible contracts is cost-per-case contracts but these were felt to be administratively too much of a burden. Cost and volume provided a compromise that was satisfactory.

Trust A also appeared to have resisted cost-per-case contracts particularly because of the amount of uncertainty involved. An unknown level of cash-flow while waiting for payment from purchasers was a potential problem. This was inevitably going to require sophisticated information systems. Current systems could meet some of the needs, but by no means all of them.

The move away from negotiating purely block contracts, points to the need for providers to accurately cost procedures and specialities. There were clearly problems with this, largely because of the necessity to have standard specifications for the outputs, and the existence of different costing methodologies. This was particularly difficult for Trust B which is predominantly a Community Trust. As mental health treatment is likely to involve many different specialities it was considered difficult to decide the standard specification for one particular type of treatment. Recent attempts to group treatments for the purposes of costing have endorsed this view (Pimm *et al.* 1996). Trust B, therefore, attempted to break down costs in terms of inputs. This involved post-suppositional questions with highly measurable outcomes. The Trust finance manager cited the example of an eating disorder service that claimed four in-patient beds in a twenty-four-bed ward. As the service was charging a price that was considered to be the best on the local market, the Trust approached its single substantial purchaser making out a case for an additional two beds. When this had been approved, the Trust considered the feasibility of establishing an eight-bed specialised unit for eating disorders with the intention of selling the extra two beds externally. In pricing these services the Trust had to consider questions such as: what if the purchaser ends up filling only five of the beds and not six? Or what if the purchaser urgently

needs eight beds? Where the manager actually had a greater degree of control, the outcome of decisions could of course be predicted with greater accuracy. Trust B also introduced the issue of competition with the private sector: a significant point since the Trust had been viewed in the past by purchasers as expensive.

Information was clearly vital to the contracting process, not simply in considering wider, strategic scenarios but in deciding what kind of contract to offer to purchasers. Not surprisingly, the finance manager at Trust A with its wider range of contract types, used more ad hoc information than Trust B to give an edge in debate with purchasers. An example would be if he thought the health authority was deliberately under-contracting. He would ask the information systems manager for information on the number of contract elements such as electives, emergencies and urgencies that have been dealt with over fixed periods of time. He would then wish to extrapolate the trend and so confidently inform the health authority that their proposed level of contract would not even cover one of the contract elements, let alone the others.

Trust B, on the other hand, with most activity taking place within a block contract, required more administrative information and drew largely on the Patient Administration System (PAS) for monitoring activity and charging for it against the contract. Some enhancements to the PAS had been necessary to incorporate more detailed information about extra contractual referrals.

Information systems for contracting

The aim, in looking at information systems, was to determine the extent to which the Trust financial managers could rely on information being available for their decision making. Therefore, the interviews with the information systems managers were aimed at establishing current systems and information availability rather than hoped for information levels.

Trust A appeared to have a wide ranging strategy for information. The manager identified several different 'publics' for which she provided information; the general public who might be patients or visitors, health authorities, fund-holders as well as internal 'publics' within the Trust itself. The provision of information for these 'publics' had necessitated the development of several operating systems such as SCOPE (operational management of administration through hospital systems) and RADICE (radiology system). The objectives of reducing duplication of data entry and producing patient rather than service oriented information systems called for centralisation in systems.

This apparent need for system centralisation was also perceived by Trust B where a business case was being drawn up to decide whether to integrate existing systems or invest in a replacement system. Previously there had simply been a need for aggregated data for the main purchaser. However, with the

increase in GP fund-holders (albeit still a small proportion of activity), the Trust found that it required more patient based data. GP fund-holders wanted to know what had happened to their individual patients. This required more detailed and personal information as well as more system support for administration in communicating with GPs. Despite the increase in information available they were still only in a position to provide fund-holders with block contracts. It was hoped that improvements in information systems would lead to a move towards cost and volume and cost-per-case contracts as the information systems improved. It was appreciated in both Trusts that the new diversity of purchaser, while administratively challenging, had resulted in vastly improved data quality within the Trust. Clinical coding of discharges, for example, had accelerated very significantly.

The type of activity information that existed within the computerised system at Trust A was categorised by in-patient, day cases, out-patient and regular day attendance enabling managers to consider amongst other things, referral patterns, discharge patterns and admission patterns. All this information, covering about one third of the Trust's services, was provided by the SCOPE system and so was easily accessible for contracting purposes. Information for a second third of the Trust's services, therapy, was still manual and therefore less flexible in terms of what managers were able to do with it. The last third, community services, was not considered by the information manager to be outcome focused at all as the currency for the contract was whole-time equivalence for health visitors or district nurses. This was input oriented since the actual activity of the health visitors and nurses wasn't part of the contract. Workload recording was manual and restricted to numbers of patients seen in a given day and numbers of miles travelled. Considerable improvements would need to take place if information systems were to provide information for costing community service contracts.

The situation in Trust B was very different since community services constituted the large majority of total activity and so the information systems had been designed to produce the sort of information that Trust A could not. This was based on a monthly schedule that detailed the activity for each of its services and which showed the variants against the contract. Thus, for services for the elderly there would be details of ward stays, finished consultant episodes and occupied bed days; for district nursing, information concentrated on the number of total contacts and the number of initial contacts. The Trust was in the process of putting in place an executive information system to monitor contracts.

Both Trusts acknowledged the fact that although the technology was generally available, it was only partially in place as far as information provision for contracting was concerned. This confirmed the findings of Appleby *et al.* (Appleby *et al.* in Robinson & Le Grand, 1994) Trust B felt that its patient based systems were still fairly basic and there was some way to go before it could monitor contracts effectively. The ability of systems in both Trusts to respond to

post-suppositional questions was limited. Trust A wanted to be able to extrapolate historical data on actual contract activity and ask for information on likely future activity on this basis. Currently it could only forecast on the basis of projections from the original expected contract activity. Nevertheless, the information systems manager felt that information enabled contract managers to stay one step ahead of purchasers even though information was nowhere near as sophisticated as it should be to deal with the complex nature of contracting and business.

Differences between the nature of contracting within the two Trusts were most evident in managers' opinions as to which contract types were most straightforward to manage. As indicated above, different contracts needed different amounts and types of information. Those that were value-led, such as block contracts, appeared to create the most problems for Trust A. The substantial numbers of GP fund-holders were keen to emphasise that the volume of work they were purchasing was not binding but that the value of the contract was. Thus, the onus of working to contract and staying within financial constraints was transferred to the Trust as service provider. The Trust's information systems were able to cope with cost and volume contracts that were preferred as more flexible and less restrictive. Trust B, on the other hand, appreciated the financial lucidity of the block contract and confirmed the impression that any contracts with GP fund-holders were going to need a great deal more information input than main purchaser block contracts.

IS: a separate issue?

The evidence collected in the interviews seems to offer support to the argument that effective systems equal effective management amongst NHS Trusts attempting to implement contracting. The argument seems to be based largely on the fact that, to varying degrees, the different types of contract need large amounts of accurate data to enable the process to work efficiently. The more sophisticated contract types were only being included in a Trust's portfolio when appropriate information systems were in place. The main points arising from the case study research are as follows:

- both Trusts envisaged more effective information management through greater systems centralisation;
- although the technology was available it was only partially in place as far as information provision for contracting was concerned. This was inhibiting the move towards cost per case contracts;
- there still exists a problem with *information provision* but both Trusts felt that there had been a massive improvement in *data quality*;
- changes to the structure of the clinical directorate (devolved budgets and doctors taking responsibility for meeting organisational objectives)

needed to be reflected in provision of information and the structure of information systems;

- processed information, reliant on effective systems was a vital resource to the Trust as provider in contract negotiations with the purchaser.

Systems fed by accurate data were clearly important for both provider and purchaser decision making. However, other organisational determinants are still important:

- one Trust mentioned the fact that the most important costing information within its systems was patient-related. Most of this information was still produced manually in many cases;
- sufficient staff were needed to operate the contracting process, particularly the cost per case contracts;
- even with sufficient information there was still an element of risk management in decision making. Time would always be a limiting factor, no matter how quickly information was made available;
- qualitative, non-price issues also play a part in contracting decision making. Support for one Trust in these decisions was available through a coalition of provider units, enabling a better understanding of the basis for pricing.

A conclusion to the research exercise would, from this, identify one important factor in NHS Trust contracting that is not straightforwardly systems related - the risk management issue. Even with efficient systems, managers are still the decision makers (about negotiations, which type of contracts to pursue etc) and success in this must depend on the skill and experience of the manager concerned as well as the information systems available. While risk aversion and limitation are features of information systems in their most developed forms, they are characteristics that are still some way off for systems in these two NHS Trusts.

THE VALUE OF CASE STUDY METHODOLOGY IN THIS PROJECT

The range of alternative research methodologies to case study analysis suggests that it was not the only viable option for this project, even for in-depth investigation. A survey method using both qualitative and quantitative data would have been just as appropriate if time and finance had allowed. Within case study research itself, more than one philosophy had to be considered. As stated earlier, Walsham's interpretative approach offers an alternative to Yin's positivist one which aims to establish measurable causal links. The interpretative approach to a case study taken by Shanks has also subsequently been seen as having parallels with the NHS case and supports some of the findings (Shanks, 1997). As noted earlier and endorsed by Patton (Patton, 1990), case studies are useful for understanding a particular problem or unique

situation where it is possible to identify cases rich in information. It could reasonably be claimed that the project was looking both at a particular issue (contract costing) and considering differences between Trusts on a wider range of topics. The extent to which the case study approach offers a means of differentiating between these is questionable but the degree to which a survey approach might have differentiated unnecessarily is also uncertain. In this instance the case study methodology provided a clear indication as to the differences in contracting philosophies between the two Trusts and also provided the context of these distinctions. However, it offered no facility for dealing with the issue of contracting aside from matters of the service portfolio or the internal structure of the Trusts. As information system theorists, we may not wish to divorce these issues, but traditional scientific thinking suggests that we should do so in the interests of analytical rigour. Nevertheless, we are sufficiently steeped in soft systems approach to know that such thinking should not deter us. This view is endorsed in the example of the NHS project by the fact that attempts to analyse the contracting process in isolation have been the source of serious financial problems for some Trusts.

Yin also makes an important point where he quotes an example that coincidentally concerns the implementation of a management information system.

The case study will show why implementation only succeeded when the organisation was able to restructure itself, and not just overlay the new MIS on the old organisational structure. (Yin, 1989: 36)

This suggests that the case study can, in the same way as a survey, highlight organisational issues and systems issues. However, the analysis of the case can also provide an explanation as to why the two are inextricably linked. The NHS Trust research project cannot claim to be statistically representative of the relationship between information systems and decisions on a national scale. However, the cases examined provided instances of organisational determinants and systems designed to support decisions based on these factors. It also enabled comparisons between Trusts of different sorts, without indicating that these comparisons are the only ones that exist in the total population of Trusts in the UK.

REFERENCES

- APPLEBY, J., SMITH, P., RANADE, W., LITTLE, V. & ROBINSON, R. (1994) Monitoring managed competition. In: R. Robinson & J. Le Grand, eds. *Evaluating the NHS reforms* London: Hermitage Policy Journals for King's Fund Institute, 25-53.
- BARWELL, F. & SPURGEON, P. (1993) *Information for effective management decision making in the NHS*. London: Longman.

- CAVAYE, A.L.M. (1996) Case study research: a multi-faceted research approach for IS. *Information Systems Journal*, 6, 227-242.
- FULLER-LOVE, N & COOPER, J. (1994) How information technology shapes strategy in the steel industry: a case study of British Steel. *International Journal of Information Management*, 14, 295-306.
- PATTON, M. (1990) *Qualitative evaluation and research methods*, 2nd ed. London: Sage.
- PIMM, P., NOBLE, A & BATES P. (1996) Group therapy, *Health Service Journal*, 1 August, 26-27.
- PRESTON H. & HAYWARD, T: *Applicability of case study methodology in IS research*. In: D. Avison, ed. *Key issues in information systems: Proceedings of the Second United Kingdom Academy of Information Systems (UKAIS) Conference, University of Southampton, 2-4 April 1997*. London: McGraw-Hill, 253-263
- ROBINSON, R. & LE GRAND, J., eds. (1994). *Evaluating the NHS reforms*. London: Hermitage Policy Journals for King's Fund Institute.
- SHANKS, G. (1997) The challenges of strategic data planning: an interpretative case study. *Journal of Strategic Information Systems*, 6, 69-90.
- STAKE, R. (1995) *The art of case study research*. London: Sage.
- WALSHAM, G. (1993) *Interpreting information systems in organizations*. Chichester: Wiley.
- YIN, R. (1989) *Case study research: design and methods*. London: Sage.