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Learning from the achievements of Information Systems – the role of the Post-Implementation Review in medium to large scale systems

1 Introduction

In the last decade, a number of papers on information systems supporting heritage records in English local and central government have been published. Several of these have stressed the considerable financial value accruing to these information systems, which may often be disguised by the relatively modest initial investment in the basic technology to sustain them. The purpose of all information systems, whether large or small, is to support the business of their parent organisation, and the process of managing these projects seeks to ensure their cost-effective and timely delivery to meet the business objectives. Regular reviews during the life cycle of the information system are an essential process to ensure these objectives are achieved.

For central government in England, Clubb (1989) has already described the Investment Appraisal process, which may govern a decision to initiate a new information system. In this paper, the authors seek to describe the logical conclusion to an implementation — the Post-Implementation Review (PIR). It is an important phase in the life cycle of all IT projects, although it is often overlooked, or paid scant attention. This paper places the PIR in the context of the systems development process, sets out potential areas of risk to projects and considers four English cases studies, of which the authors of the paper have first-hand experience:

- the English Heritage Record of Scheduled Monuments (RSM),
- the Royal Commission on Historical Monuments of England (RCHME) National Monuments Record, MONARCH,
- the Greater London Council/English Heritage Greater London Sites and Monuments Record,
- the West Midlands Sites and Monuments Record.

The implementation of all new computing systems requires, to some degree, a process of learning. Heritage computing will only progress if we are all willing to share the knowledge derived from this process, both good and otherwise. We are grateful that colleagues in the organisations mentioned in this paper have been willing to share their experiences in this way.

2 The system development process and areas of risk to the success of information systems projects

Large information systems projects usually require to be managed through a series of discrete stages, sometimes called the system development process or project life cycle. A typical project life cycle will follow some or all of the following stages illustrated in figure 1 (not necessarily in the order shown, since certain processes may run concurrently).

The PIR occupies a critical role in the system development process in reviewing the system as implemented against the original assumptions and preparing the way for future developments. Before embarking on a major system, it is worth examining in advance some of the areas of potential risks. These should be anticipated in the Investment Appraisal (Clubb 1989) which should include both an appraisal of risk and the testing of the sensitivity of the investment to changes in the fundamental assumptions inherent in a project.

2.1 Areas of risk:

All information systems are susceptible to a number of areas of risk. These may include some or all of the following:

- lack of clearly defined objectives and benefits,
- lack of user commitment or system ‘ownership’,
- failure to improve data/procedures *before* developing new systems,
- lack of formal project management/development methodologies,
- lack of clearly defined project rules,
- failure to define acceptance criteria and testing protocols
- failure to estimate adequate resource, including training and documentation,
- failure to assess hardware/software capacity,
- failure to establish formal disaster recovery plans and security standards,
- lack of legal/contractual advice on relationships with suppliers,
- lack of documentation.

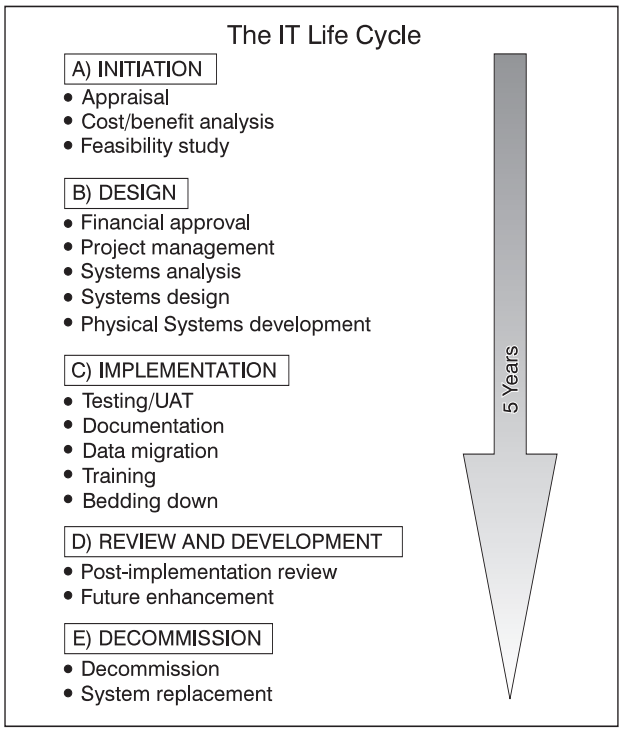

Figure 1. The IT life cycle.

Those responsible for managing an information project should ideally have the necessary experience to anticipate risks and act to minimise them.

2.2 The Role of the Post-Implementation Review

In the system development cycle, the PIR performs a critical role in assessing the achievements of a system against the original expectations which justified the decision to invest in its development. If an organisation does not conduct reviews, then it is likely that its information systems will not be properly managed. Money will be wasted because it is likely that:

– information systems will not be fully aligned with the business objectives of the organisation,
– the organisation which has funded the initiative will have no means of knowing whether its investment is providing value for money,
– benefits management will not be effective and the benefits predicted in the business cases will not be realised,
– the costs and risks to the enterprise will not be minimised,
– generic lessons, of use to future implementations within the organisation and to others will not be assimilated.

The PIR is normally initiated when the new system is fully implemented and when the users are fully conversant with its features and facilities. The timing of the review needs careful judgement. For micro-systems, normally, about three months after implementation is appropriate. For larger scale systems, the review would normally be conducted between six and twelve months after implementation. If the review takes place too soon, then it may attach undue importance to what are no more than short-term technical issues and this may lead to erroneous conclusions. The focus of the review should, in the main, be on the medium to long term and the degree to which the system supports the business activity. It is particularly important that the timing of the review adequately covers any cyclical features, such as quarterly, bi-annual or annual tasks which the system is expected to perform.

In summary then, the primary purpose of the review is to determine whether:

– events have proved the validity of the planning assumptions,
– the claimed savings and/or benefits have been achieved.

The scope of a PIR will be governed by the size and the complexity of the project to which it relates. For simple micro-systems, this may be a very brief document, but this in no way lessens the desirability of holding the review. For larger systems, PIRs can often be extensive documents, and consideration should be given to the adoption of a formal review methodology such as MEVIOS (Method for Evaluating the Impact of Office Systems, CCTA 1989).

Information for the PIR can be gathered from:

– interview or the circulation of questionnaires to those operating and using the system,
– examining system documentation such as project minutes, user and training documentation, testing protocols, system maintenance logs and computer resource accounting packages,
– observations on the business and IT operations,
– feedback from external clients of the system, where appropriate.

The PIR may be undertaken as an in-house review, or by an external consultant. As one of its final actions, the IT project board overseeing the project should have set up the terms of reference for the review. The key issue is to ensure that the process is undertaken as objectively as possible. This usually means that the report should be prepared by someone not directly involved with the project, either as developer or user.

A formal methodology for risk assessment, such as CRAMM (Computer Risk Analysis and Management

Models, CCTA 1988) and general security issues should be undertaken periodically after any significant new change to a system.

Against this background, the authors would like to examine four case studies, two drawn from central government records systems, the Record of Scheduled Monuments, operated by English Heritage, and the National Monuments Record application (MONARCH) run by the RCHME, and two at a local level, the Greater London Sites and Monuments Record (SMR), now managed by English Heritage, and the West Midlands SMR, run by the West Midlands Joint Data Team, a jointly sponsored body established to service strategic information systems requirements by the seven metropolitan district councils of the West Midlands County.

All four systems are substantially successful, but they all provide lessons for their host organisation, as well as for others.

3 English Heritage – Record of Scheduled Monuments

3.1 Objectives of the system

The objectives and implementation of the English Heritage RSM are well documented elsewhere (Clubb 1991a, 1991b; Clubb/Startin 1995). The system curates the national database of scheduled monuments and automates the complex processes involved in the identification, legal protection and management of the most important archaeological sites in England.

3.2 Implementation history

A cost-benefit analysis carried out in 1988 concluded that the costs of the system of £ 605,380 over a 7 year period would represent savings over a range of alternative ways of meeting the requirement. The investment appraisal associated with the decision to develop the system is discussed in Clubb 1989 and included an element of both risk analysis and sensitivity testing. The system was developed during 1990-1991 using the Oracle relational database.

3.3 Post-implementation review

The PIR was carried out by external consultants and completed in April 1992. The system was undoubtedly a success in terms of automating the procedures of scheduling monuments. The PIR identified strengths in the project implementation as follows:

- significant financial savings achieved,
- systems liked by staff,
- system analysis, design and programming handled well,
- reliable application software,
- meets original design specification, administrative activities and data storage requirements,
- choice of Oracle software will facilitate links with RCHME systems and sharing of expertise between English Heritage and RCHME.

3.4 Conclusion

The PIR also concluded that some lessons could be drawn from the project. Although system analysis, design and programming had been handled well, it was noted that system testing, user acceptance and data take-on experienced delays. It was also noted that without the dedication and sheer tenacity of key members of staff, several aspects of the project would have been unlikely to have been successfully implemented. It recommended that the English Heritage information technology system development standards provided a good basic framework, but required strengthening. It also commented on the need for formal project management methodologies. Other recommendations identified the need for regular planning exercises on hardware capacity and for English Heritage to review the balance between local information technology support and the need for a large central support and maintenance team.

4 Royal Commission on Historical Monuments (RCHME) – National Monuments Record (MONARCH) system

4.1 Objectives of the system

The objectives of the MONARCH system are discussed elsewhere (Beagrie 1993). It sought to unify a number of existing computer databases within the RCHME, provide a single point of entry to RCHME information systems for external users and staff and to offer a number of other benefits of convenience, speed and scope of coverage. The system presents a new model of the relationships between monuments and their associated archives and events.

4.2 Implementation history

The first major computer implementation in RCHME was the National Archaeological Record (NAR) from 1984 (Aberg/Leech 1992; Beagrie 1993; Grant 1985; Hart/Leech 1989; Lang 1995). A strategic review of future requirements was carried out in 1990 and this recommended the development of a unified database to replace the original NAR database and a number of other archaeological and buildings databases. The key elements of the new system were Monument Recording, Activities/Event Recording, Archive and Bibliographic Recording and persons/organisation. This system was developed in 1991-1992 and implemented in 1993.

4.3 Post-implementation review

The PIR was carried out by a senior member of RCHME staff who was independent of the MONARCH system development process and reported in December, 1994. The system undoubtedly broke new ground in analysing the relationship between monuments and their sources. The PIR identified strengths in the project implementation as follows:

– underlying philosophy and architecture excellent,
– opened internal communication and discussion of harmony of working procedures,
– considerable range and complexity of retrieval mechanism,
– successfully handles large quantities of complex data,
- links, associations and cross-references a major development in concept and functionality.

4.4 Conclusion

The PIR also concluded that some lessons could be drawn from the project. The decision to proceed with the system was based on the corporate benefits of a unified database which should have been underpinned by a formal cost-benefit analysis. This would make it much easier to assess the strengths and weaknesses of the new system against the original assumptions. Most of the other issues raised relate to the need to develop project management methodologies and to ensure proper training and involvement of staff. The PIR also examined the timing of the introduction of a new system. Sometimes a project may act as a catalyst for corporate improvements in existing working arrangements and procedures. It is debatable whether a more effective approach is to review existing working practices and procedures *before* system development is undertaken. These are issues on which an organisation must exercise judgement in devising an implementation plan.

5. Greater London Council/English Heritage – The Greater London Sites and Monuments Record

5.1 Objectives of the system

Details of the original objectives and implementation of the Greater London SMR have been published (Clubb/ James 1985; Jones 1989). The objectives are similar to those of the West Midlands SMR (discussed below), although there was a greater emphasis on historic buildings as well as archaeological sites and monuments. This reflected the original sponsor of the SMR, the Historic Buildings Division of the Greater London Council (GLC), which worked in close association with the museums and archaeological services for London in developing the project.

5.2 Implementation history

The Greater London SMR was first developed in the period 1984-1986 on an ADABAS database on the GLC main-frame. On the abolition of the GLC in 1986, the project was transferred to the London Region of English Heritage with a privatised computer bureau service provided by Hoskins plc. The costs of the bureau service were considerable, nearly £ 100,000 pa and following a consultants' report in November 1987 it was decided to re-develop the computer system using Oracle as an in-house facility. This was estimated to cost £ 200,000, but the lower running costs subsequently were expected to ensure that there were significant financial advantages in the proposal, as well as benefits in the migration from ADABAS to the Oracle relational database. The transfer took place in 1991-1992.

5.3 Post-implementation review

The PIR was carried out by external consultants and completed in March 1993. The project is undoubtedly a success in providing a better, less expensive system. The PIR identified significant strengths in the project implementation. These are summarised below:

– project delivered on time and on budget,
– successful migration from old to new system,
– system testing was effective,
– improved functionality,
– good change control procedures,
– significant financial savings achieved (about £ 37,880 pa).

5.4 Conclusion

The PIR also considered that some lessons could be drawn from the project. Although it should be regarded as successful in terms of the original objectives, the success was due to the natural ability of those concerned and relied heavily on the abilities of those individuals. The consultants concluded that any degree of risk to the project could have been minimised by the use of a structured project management methodology and with associated project management tools. They also recommended that project managers should be trained in project management. Of some interest is the suggestion that the envisaged benefits from the system should not just have centred on the benefits of an outside bureau versus an in-house operation but should have re-visited the SMR from first principles and considered the total cost of the system against the benefits rather than just the savings.

6 West Midlands SMR

6.1 Objectives of the system

Details of the organisational objectives and implementation of the West Midlands SMR have been published (Lang

1989; Lang/Stead 1992). In essence, these were to establish a computerised inventory of archaeological and architectural sites and monuments to provide for more effective management and planning control of this resource, though the details of how the system would support these functions were not established prior to implementation.

6.2 Implementation history

The West Midlands SMR was developed as a stand-alone computerised system from 1987 onwards on a PC using Superfile database management system software. It closely followed the standard of DoE Advisory Note 32 (DoE 1981). In common with many SMRs, the initial capital set-up costs were very low, amounting to around £ 4,000. However, by the end of the four year strategic plan for its development, investment in the system, including data entry costs, amounted to some £ 75,000. In 1989, on transfer to the West Midlands Joint Data Team, an organisation of around 40 information professionals providing information processing and analytical services for the 7 West Midlands District Councils, it was decided to develop a new system to improve data handling, development control, and cartographic manipulation. Although resources for the SMR were scarce, by combining this initiative with other requirements within the Data Team, it was possible to justify the investment. Following an extensive evaluation, a solution using a relational database and GIS software (INGRES and Genamap) was selected and prototype systems were constructed.

6.3 Post-implementation review

In common with the majority of SMR systems established in local government, no formal process of review was required either by the host authority or by English Heritage, as the initial grant aiding body (although monitoring of data entry rates was conducted throughout the period of grant aid, see below). The strengths of the systems development may be summarised as follows:

- development costs were shared with other functions within the organisation,
- the operational requirement was clearly established and the procurement was carefully controlled,
- there was close integration of database and spatial GIS elements of the system,
- it met its principal requirement -development control- both through the SMR and in support of archaeological development control functions elsewhere,
- the analysis for the system broke new ground through defining generic groupings of related monument types,
- the system provided both tangible and intangible benefits through enhanced functionality.

6.4 Conclusion

There were also some areas where the review indicated improvements could have been made. The main areas of weakness were in underestimating resource requirements for the development. In common with most local government SMRs, the conflicting pressures of development control-related work, and maintenance of the existing system, meant that development work could not be reliably programmed and progress was slower than anticipated. This could have been avoided through including external technical consultancy in the development of the system, though, given the constraints of local government funding, it is not certain whether this could have been better resourced. Finally, the project was (perhaps inevitably in such a small team) closely identified with a single member of staff. The subsequent departure of that member of staff has caused considerable delays to the full implementation of the system as originally envisaged.

7 Conclusions

Post-implementation reviews are an essential mechanism for minimising risk in IT systems, and should be seen as an integral and indispensable part of the overall review process within the life cycle of an information system. The examples quoted above provide solid examples of the benefits derived from a formal review, and also point to some of the dangers in failing to measure system performance against the original expectations of the system, as opposed to the performance of individuals as processors of data. They also stress the need for formal methodologies and the potential risk of depending on a small number of individuals.

In central government, PIRs are an expected part of all significant IT projects, and for major initiatives, these are normally conducted by external consultants. Post-implementation reviews are also accepted practice in local government computing, but do not tend to be applied as a formal requirement in quite the same way. In the case of local authority SMRs, very few have been subject to a formal review process, with, in many cases, adverse consequences.

The original justification for computerised local SMRs was made largely by the Department of the Environment (and later by English Heritage) at a central government level. English Heritage took responsibility during the 1980s for the extensive ‘pump-priming’ of local government SMR systems, having a considerable influence over the choice of software systems used in over half of the 46 County SMRs. While local government officers took up the development of these systems with considerable enthusiasm, the responsibility for ensuring the effective initial implementation of these systems through the review process must rest with central government.

The initial supervision of local SMR implementations was made almost entirely by the Department of the Environment Ancient Monuments Inspectorate (English Heritage after 1986), which consisted of archaeological professionals who were not necessarily 'computer literate'. Their concern rested largely with the achievement of data entry rates as a key performance indicator, rather than with the quality of the system developed, the integrity of records being entered or the testing of assumptions about the ability of these systems to answer questions in the furtherance of central and local government objectives. These were regarded as local matters, although as early as 1984, one member of the Inspectorate was lamenting that there had been no formal analysis of the operational requirement and functionality for SMRs (Inspectorate of Ancient Monuments 1984).

In local government as a whole, SMRs are generally considered to be peripheral IT systems. It may be argued that the case for making these more robust would be enhanced through the adoption of formal review methodologies. Following the establishment of a lead coordinating role for local authority SMRs, RCHME is helping to support audits of sites and monuments records considering taking the PC version of the MONARCH database. Although these are not intended as PIRs, much of the information provided through the audit could be used, with minimal further translation, to form the basis for a PIR, and are being used to make the case for further IT development.

In general, the required investment in technical development and maintenance of local SMR systems has been substantially underestimated, with only a minority having defined the resources for formal development. Nonetheless, the majority of local SMRs report that their systems *do* successfully support their internal functions qualitatively, but their ability to provide statistics for national programmes has often been found to be more limited.

The lack of formal management methodologies in IT planning for local SMRs means that further investment is now required to maximise the benefits from these systems, including the establishment of efficient protocols for digital data exchange with the RCHME National Monuments Record and other relevant bodies. This is not simply a question of providing resources to support data preparation and input (though both should be covered in IT planning). It is equally a question of the need to review and to measure performance against original objectives. These are areas where the RCHME, as the lead co-ordinating body for SMRs, should, perhaps, develop a more proactive role in the future, in the light of experience of PIRs of their own systems.

Our companion paper in this volume (Clubb/Lang 'A Strategic Appraisal of Information Systems') includes an extensive bibliography, with relevant additional literature to that specifically cited in the text. The paper seeks to achieve a strategic appraisal of monuments records in England and PIRs have a critical role to play in helping to refine this process.

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