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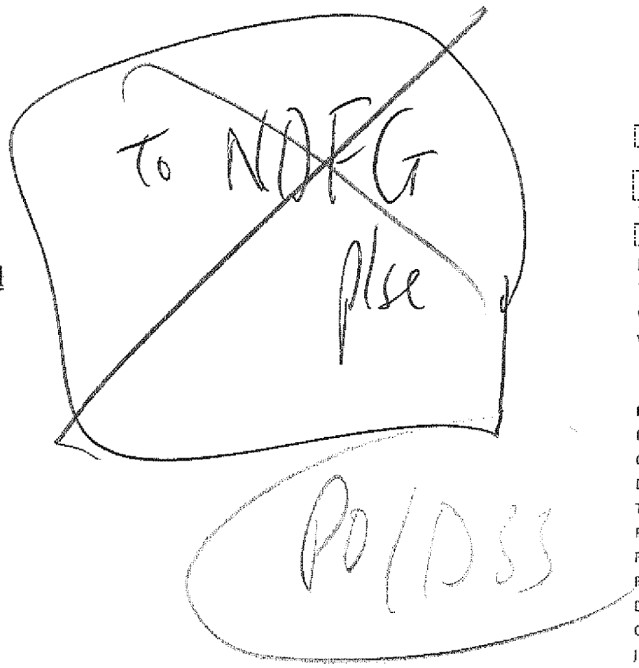

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4 May 1999

Legally Privileged & Confidential

Ms Patricia Kelsey
BA/POCL Programme
Third Floor
Terminal House
52 Grosvenor Gardens
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Dear Pat,

PROJECT MENTORS' SUPPORTING REPORTS

As previously promised, Project Mentors has now completed three supporting Reports which I now attach. These support their Management Summary Report, which I circulated last week.

As in the past, the attached Reports are legally privileged on the basis that they were commissiond by us as the Joint Programme Lawyers. Accordingly, they should be given the most limited possible circulation within your organisation on a need to know basis.

Yours sincerely,

GRO

HAMISH SANDISON

Encls

cc. Vince Gaskell, BA
Sarah Graham, DSS
Dave Miller, Horizon
Ron Powell, DSS
Paul Rich, POCL
Jeff Triggs, Slaughter and May

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REPORT
PATHWAY SYSTEMS DEVELOPMENT PROJECT
SYSTEMS DEVELOPMENT APPROACH

Ref: A.41.06 V1.9
Status: Provisional
Prepared: April 1999

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Pathway Systems Development Project - Systems Development Approach

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1 INTRODUCTION

1.1 Context

This report is one of a set of related reports commissioned to support potential litigation and negotiations for settlement of that litigation with respect to the Card Payment Programme. The structure of this set of related reports is illustrated in figure 1.1 below, which highlights the position of this report within that structure.

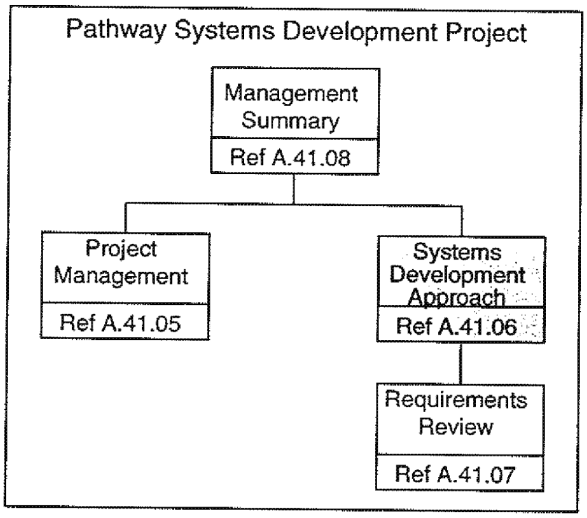

Figure 1.1 - Structure of Related Reports

This report describes our findings with respect to Pathway's development approach, while the "*Project Management*" report [Ref. A.41.05] sets out our assessment of their management of the project. The "*Requirements Review*" report [Ref. A.41.07] provides additional technical information. The overall findings of our review are set out in "*Pathway Systems Development Project - Management Summary*" [Ref. A.41.08].

It should be noted that there are links between the management and technical factors, and ideally this system development approach report should be read in conjunction with its companion papers.

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1.2 Scope of this Report

The Card Payment Programme calls for the provision of a wide range of **services** by the CONTRACTOR (Pathway Ltd.) for the Benefits Agency (BA) of the Department of Social Security (DSS) and Post Office Counters Limited (POCL). Three related agreements define the rights and obligations of the parties in providing these services. The agreements are between Pathway and the DSS and POCL jointly (the Authorities agreement) and between Pathway and the DSS and between Pathway and POCL.

The services to be supplied under the agreements are Development Services, Rollout Services, Steady State Services, Management Services, Contingency Services and Transfer Services. This report, and its companions, are concerned only with the development services, which include:

- PAS - Payment Authorisation Service;
- CMS - Card Management Service;
- BES - Benefit Encashment Service;
- APS - Automated Payments Service;
- EPOSS - Electronic Point of Sale Service.

A number of other development services are identified in the relevant agreements or schedules to those agreements as contingency, optional or additional services. Apart from the Order Book Control Service (OBCS), which is a POCL optional service, none have been covered in this review.

The services could not be supplied in any way which met the expressed requirements of the Authorities without the support of computer based systems. Therefore the systems are fundamental to the services provision. The related agreements clearly place responsibility with Pathway for the provision of these systems, together with the necessary interfaces between them and other DSS and POCL systems. Appendix A of our report *"Pathway Systems Development Project - Project Management"* [Ref. A.41.05] lists the relevant clauses and schedules supporting this allocation of responsibility.

Under the related agreements, Pathway has the authority to determine whether each system can be an existing (packaged) system, a modified package or be developed from scratch. However, whichever route is chosen, the end results must meet the requirements of the Authorities and support the solution defined by Pathway.

We describe the provision of these systems as the development project, shortened to the **project**, in contrast to the overall provision of the services which depend on them. The systems which the project will provide we have collectively called the **system**. We have not reviewed the service provision aspects of the Card Payment Programme because the system has yet to be completed.

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1.3 Purpose

This report has been commissioned to support potential litigation and negotiations for settlement of that litigation. It therefore aims to provide negotiators, who may not be wholly familiar with IT developments, with an assessment of Pathway's performance in this area.

Because people without a systems background may use the report, we have striven to provide a view that we trust will be readily comprehensible. We have as far as possible avoided the use of IT "jargon". However, the concepts described in this report need to be understood if the scale and impact of failures in following good systems development practice are to be recognised.

1.4 Constraints

Currently (April 1999) we do not have access to Pathway documents or to their staff. In consequence, our findings are based on:

- relevant items in the Authorities possession;
- the absence of material which it might reasonably be expected Pathway would have prepared and passed to the Authorities;
- our assessment of the causes behind various events in the project's history.

1.5 Structure of Report

The report is structured into the following chapters:

- Chapter 1, this chapter, presents background information;
- Chapter 2 is the management summary;
- Chapter 3 describes the general steps in the life of IT systems - the System Development Life Cycle;
- Chapter 4 describes how IT professionals have designed methods for successfully developing IT system. Particular focus is given to SSADM;
- Chapter 5 describes the principle stages in assuring the quality of software developed during an IT project;
- Chapter 6 compares Pathway's approach against that of SSADM, and reviews Pathway's approach to quality assurance;
- Appendix A provides an outline description of the primary products from an SSADM project.

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2 MANAGEMENT SUMMARY

2.1 Good Practice

Most Information Systems use a similar development and maintenance process, usually known as a System Development Life Cycle (SDLC). They are not all developed and operated in the same way, but they mostly pass through the similar phases in their lifetime. Managing the development of an IT system is inherently difficult. Maximising the possibility of a successful outcome requires a clear understanding of the requirements to be met and the process and techniques to be used during the project. The IT industry has evolved and developed, sometimes through painful experience, a general approach that is considered 'good practice'. This approach has been embodied in a number of 'Structured Systems Development Methods' (Structured Methods).

Structured methods consist of two basic elements:

1. A *default structure* of steps and tasks which the project team should consider following.
2. A set of techniques to be applied in each step that provide *structured* definitions of user requirements and system components.

Structured methods move the project forward through analysis and design, using techniques that gradually transform user requirements into a system specification, from which the system's software can be developed and tested. In our opinion, it is generally accepted that IT projects following good practice will adopt a structured method.

Good practice also demands that the quality of the developed system is fit for purpose. Formal Quality Assurance should be an integral part of a project's development approach. Documents will be reviewed and approved by interested parties, while software will be tested against its specification. Testing will be performed by both developer and business users to demonstrate correctness and acceptability.

2.2 Pathway's Approach

2.2.1 Evaluation Framework

In examining Pathway's approach to the development of the Card Payment system we have had the following questions foremost in our minds:

- what structured method has Pathway used during the project?
- what system development activities have been performed and what have been the products of those activities?

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- what quality assurance approach has Pathway adopted to ensure that the quality of documents and software meets the Authorities needs?

We would have reviewed Pathway's own description of their development approach. However, Pathway has not provided the Authorities with such a description. We have therefore had to infer their approach from the documentation we have examined.

In illustrating Pathway's approach we felt it appropriate to compare their development steps and products with one of the well-accepted commercially available methods. Structured Systems Analysis and Design Method (SSADM) is the standard Information System development method for UK government projects, and has become a de facto standard for much of the UK private sector. We therefore chose SSADM as our comparison template. However, it must be emphasised that another structured method would have served equally well.

SSADM covers most of the system life cycle from feasibility study through to system design. We compared stages of the Card Payment project with those of SSADM identifying the relevant responsibilities of Pathway and the Authorities. The following diagram illustrates the SSADM stages and responsibilities

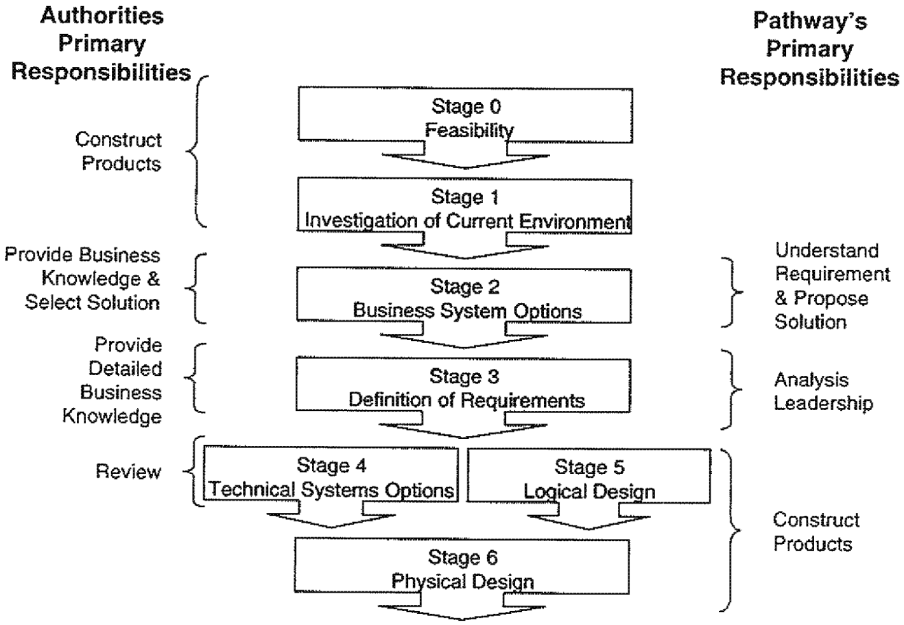

Figure 2.1 - SSADM Stage Responsibilities

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2.2.2 Stages 0 & 1

The work performed by the Authorities during the period up to the publication of the Statement of Service Requirement (SSR) "*Bringing Technology to Post Offices and Benefit Payments: Statement of Service Requirement - March 1995 Final version 6*" [Ref. 3] was equivalent to SSADM stages 0 and 1 and was their sole responsibility.

2.2.3 Stage 2

In broad terms, this was the period of demonstration, ITT production, vendor selection and contract production. The vendors each proposed a solution and the Authorities selected Pathway's. During this period Pathway had ample opportunity to clarify requirements to the degree necessary to select and design an appropriate solution and to plan its development. However, there is little evidence that Pathway attempted to understand the Authorities requirements beyond the level expressed in the SSR and contract. In particular it appears that Pathway did not begin to build the foundation for the detailed analysis that should have followed contract signing.

It should be noted that although Pathway's solution matched the contract requirements catalogue point for point, the catalogue requirements are not at a level of detail from which a system specification and design can be developed.

2.2.4 Stage 3

The equivalent of SSADM Stage 3 began immediately after contract signing. This stage should have focused upon agreeing, in precise detail, **what** the Pathway service was to deliver. Pathway's responsibility was to ensure that it had a clear and precise definition of what the Authorities required. The Authorities responsibility was to provide all necessary information in response to Pathway's requests. Leadership should have come from Pathway since this stage uses techniques which require IT specialist skills, rather than the business skills and knowledge held by the Authorities.

Pathway did not produce a detailed analysis of the Authorities requirements. Isolated problem areas, such as Foreign Encashments, have received particular attention. However, there is no coherent detailed requirements specification. In particular the following **critical** products have not been submitted for agreement:

- an agreed detailed definition of the Authorities' business data;
- an agreed detailed definition of the Authorities' business rules;
- an agreed detailed specification of the Pathway solution and how this meets the Authorities' business requirements.

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2.2.5 Stages 4,5 & 6

While SSADM Stage 3 is concerned with what has to be delivered, Stages 4, 5 and 6 are related to design and development, and thus to **how** the service is to be delivered. The **how** is Pathway's responsibility and Pathway has been most protective of their right to design and develop their solution. The Authorities responsibilities should have been limited to the review and approval of detailed design where it has a direct impact upon the Authorities - for example the appearance of the counter clerk's screen.

2.2.6 Quality Assurance

Since there is no requirements specification, Pathway's testing of the system can only demonstrate conformance with the contract requirements catalogue and with Pathway's own internal specifications. It cannot demonstrate conformance with the Authorities' detailed requirements, since these have not been documented.

2.3 Conclusions & Impacts

2.3.1 Conclusions

From our analysis we conclude that Pathway made no attempt to undertake requirements analysis in accordance with normal industry practice. This despite their having access to the SSR and subsequent requirements since April 1995. Much of this work could, and should, have been done during the demonstrator period.

In more specific terms, we conclude that:

- Pathway failed to satisfactorily analyse the Authorities' requirements during the procurement process and as a result significantly underestimated the effort and time required to develop their solution;
- in the period since contract signing Pathway has failed to analyse satisfactorily the Authorities' detailed requirements. As a result Pathway has designed and partially built a system without knowing whether it fully meets the Authorities' requirements;
- Pathway has failed to employ 'good practice' techniques for establishing detailed requirements, apparently in breach of Clause 702 of the Authorities Agreement.

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2.3.2 Impacts on the Programme to Date

Without having completed an analysis of the business requirements set out in the contract, Pathway can never have been in a position to understand the detail of the those requirements. Without that detail it is not possible to develop a system level specification to bridge the gap between requirements and program specifications. Without such a system specification it is difficult to design programs in a way which ensures that all system requirements are catered for.

"Optimisation"

Failure to complete requirements analysis and the consequent lack of detailed understanding of what is required is, we believe, at the heart of Pathway's complaints that the Authorities are "seeking to optimise the system". What they see as optimisations are in reality the detailing of the business requirements. A competent analysis would have identified these:

- more comprehensively;
- earlier in the project, giving all parties more opportunity to consider and agree options;
- at a point where they could have been incorporated into a coherent design at minimal cost.

Estimating and Planning

Requirements analysis is fundamental to preparing estimates of the effort required to develop software. Without estimates it is not possible to establish resource requirements, nor to develop a soundly based schedule. The lack of requirements analysis meant that Pathway's estimates had no firm foundation. The continuing delays to the project schedule reflect this.

Other Elements of the System

We have performed a high level analysis of the requirements for the BPS and EPOSS system elements, not for other parts of the system. Nevertheless, we have grave concerns that the lack of professional analysis we found in the BPS and EPOSS elements would also be found in other areas if the necessary work were undertaken. These concerns are supported by a number of interviews with Authorities' staff, from which it is apparent that Pathway are loath to release design documents to BA/POCL. While they have on occasion cited Intellectual Property Rights as a reason for refusal, we suspect that the right level of documentation has not been developed.

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2.3.3 Impacts on the Programme in the Future

Our experience of systems where requirements have not been analysed satisfactorily is that the system fails to support users' needs. An effective acceptance test will identify many such failings, necessitating rework. The result is an extension of the time and cost to complete the system and roll it out. The alternative is to allow unacceptable processing in the operational environment, with unpredictable and potentially damaging results.

In our opinion, Pathway's failure to analyse the requirements satisfactorily presents a high risk that users' needs will not be met fully by the system so far developed. This may necessitate significant rework as testing continues with a consequent, but unpredictable, extension of time-scales.

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3 THE SYSTEM DEVELOPMENT LIFE CYCLE

3.1 Introduction

Most information systems share a common development and maintenance process - usually known as a System Development Life Cycle (SDLC). This is not to say that they are all developed and operated in the same way, but that they will all pass through the same basic phases in their lifetime.

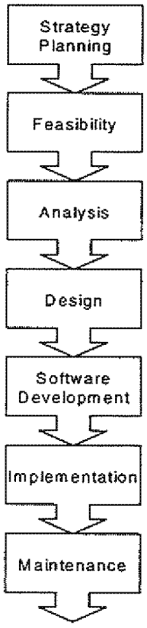

Figure 3.1 - Basic System Development Life Cycle

Figure 3.1 above illustrates one version of this life cycle. There are many variants, some sub-dividing these phases into smaller units, others merging them. However, all follow a similar structure.

3.2 Components of SDLC

3.2.1 Strategy Planning

In most organisations there will be a formal mechanism for deciding which areas of the business require new or enhanced computer systems. This may be referred to as strategy planning or something similar, but will always involve assessing the relative priorities of different areas, with a view to initiating one or more development projects.

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3.2.2 Feasibility Study

Before system development begins in earnest it is often appropriate to establish its feasibility, although sometimes there is no choice in the matter; organisations may have to provide computer support to remain competitive or to comply with legislation. The ideas that come out of strategy planning are often vague and untried. Some assessment of their feasibility needs to be carried out before too much time and effort is spent on projects that cannot be cost justified or that are technically impossible.

3.2.3 Systems Analysis

Once the project is underway the first task is to establish the requirements of users, and hence of the business. At this point some idea of the eventual shape of the system may exist. However, the primary aim is to concentrate on what it should deliver, rather than how it should deliver it.

3.2.4 System Design

This is the translation of the user requirements gathered during systems analysis into a computer system design. It details exactly how the requirements will be satisfied.

3.2.5 Software Development

The system design provides a blueprint for developing and testing the new system's software, whether this is a modification of an established package or a bespoke development.

3.2.6 Implementation

It is during implementation that programs and hardware are installed, and users trained and assisted in moving over to using the new system.

3.2.7 Maintenance

This is often referred to as the production or operational phase, and covers the period when the system is up and running in support of the business. It is the period where the system will need to be enhanced in response to changing business requirements. Any errors discovered in the system will also need to be rectified.

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4 SYSTEM DEVELOPMENT METHODS AND SSADM

4.1 Background

In the early days of systems development (1960s and 1970s) each individual developer or project team would devise their own method of moving through the life cycle, often influenced by hardware and software considerations. This did not always lead to the best system design or to the easiest of systems to maintain. Most of the problems with systems developed in this way were due to poor communication of ideas, between users and developers, or between a system's designers and its maintainers, and to lack of rigour which led to errors and omissions.

Initial efforts in overcoming these problems were directed at the programming or implementation end of the life cycle. Traditional programming methods tended to result in code that was understood by the person who wrote it, but was virtually incomprehensible to anyone else. This meant that it was difficult to maintain or to identify and remove residual errors (debug). Structured programming methods were developed to overcome this problem by providing a series of steps and diagrammatic program design techniques to ensure that code was:

- well structured and easy to follow;
- based on consistent and effective design principles;
- accurately specified.

Their structured nature also meant that programming activities could be managed and quality controlled more effectively.

While this resulted in greatly improved program quality, it did not address the whole development life cycle. There is no point in producing well designed and coded programs that fail to provide the facilities that users need to support the business. So attention turned to the earlier phases of the life cycle and in particular systems analysis and design. The result has been a number of 'Structured Systems Development Methods' (Structured Methods).

Structured methods consist of two basic elements:

1. A *default structure* of steps and tasks which the project team should consider following.
2. A set of techniques to be applied in each step that provide (largely diagrammatic) *structured* definitions of user requirements and system components.

Many claims have been made about the effectiveness and benefits of structured methods. The main claim is that systems more closely match the needs of users because user requirements have been better understood and communicated from the outset. This is achieved by applying rigorous techniques that force analysts to examine the business problem thoroughly, and by improving communication through the use of structured diagrams that

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are easily understood and less ambiguous than text. By providing a firm structure of steps and checkpoints throughout the life cycle, projects can be carefully managed and personnel skills can be used effectively.

Structured methods move the project forward through analysis and design, using techniques that gradually transform user requirements into a system specification, interrelating and cross-referencing with each other. This ensures that information is not lost.

It is also claimed that structured methods reduce the costs of a system, but it must be stressed that this is over the entire life of the system and not just in the analysis and design phases. It is precisely because more effort is spent during analysis and design that the resulting system should require less maintenance (due to higher quality, greater flexibility and fewer errors). Bearing in mind that maintenance may account for 70% of the lifetime cost of many systems, savings in this area are likely to outweigh increased costs in other phases.

Finally, most structured methods are self-documenting. They produce a comprehensive description of the system and how it operates as part of the analysis and design process. This removes the need to set up a separate documentation task once the system is in production (a notoriously onerous task), and again ensures consistency.

The increasing need for the development of systems with sophisticated screen interfaces has led to the development a number of structured methods which focus upon evolving the optimum 'user interface'. Although known as 'Rapid Application Development' (RAD) methods, they still follow the basic system development life cycle. They demand early development of 'screen' software that is reviewed by potential users, modified to take their comments into account, and presented for further review. This cycle may be repeated several times. RAD is also used for developing systems to support new business ventures where detailed requirements are not yet understood. However, where the new system is to support an established business environment, the detailed business requirements must still be formally analysed prior to software development.

The UK Government has adopted structured methods as a standard for all IS projects. Structured Systems Analysis and Design Method (SSADM) is the standard Information System development method for UK government projects, and has become a de facto standard for much of the UK private sector. It also forms the core of numerous courses at HND, BSc and MSc levels.

4.2 SSADM

SSADM is a well-tried and comprehensive method. It starts by building a high level picture of system requirements that are gradually refined so that a detailed and rigorous system design can be produced. This is achieved through the careful and staged application of a range of standard techniques. The structural framework of SSADM controls the whole process.

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4.3 SSADM Life Cycle Coverage

SSADM covers most of the system life cycle from feasibility study to system design (see Figure 4.1 below).

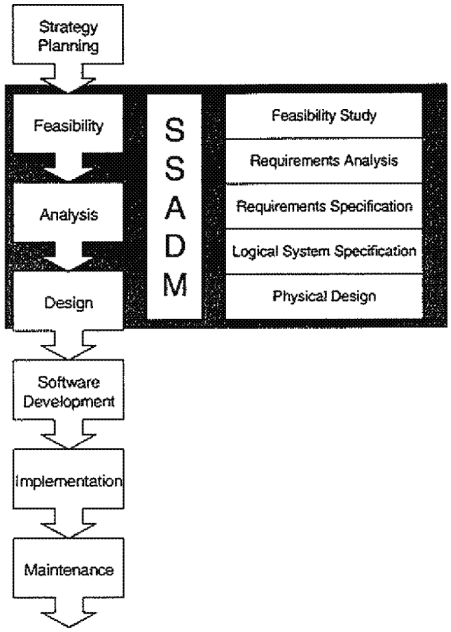

Figure 4.1 - SSADM Life Cycle

4.4 SSADM Principles

4.4.1 User Involvement

On too many occasions in the past users' requirements have been lost or overridden by IT analysts and designers. It is a prerequisite for SSADM that user commitment and involvement are agreed right from the start. Most of SSADM's techniques can be taught to users without any prior experience of IS development. They can then participate fully in the project.

4.4.2 The Three Views of SSADM

SSADM looks at a system from three different, but highly interdependent perspectives:

- The first is that of functionality or processing. This looks at the way in which data is passed around the system and the processes or activities that transform it, i.e. it sets out the functions provided for users by the system.

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- The second is that of data. An Information System exists only to store and act upon an organisation's data. By understanding the true nature and structure of the data we get to the real heart of the system. Data structures are far more constant than processing or functions, which tend to change fairly frequently; so it is the data view that forms the backbone of SSADM. In this sense SSADM belongs to the family of structured methods referred to as 'data driven'.
- The final view looks at the effects of time and real world 'events' on the data held within the system. Whereas the function and data views are rather 'snapshot' in nature, the event view is dynamic; it is specifically designed to model system behaviour over time.

4.4.3 Separation of Logical and Physical Models

One extremely important concept in SSADM (as in most rigorous methods) is the distinction between logical and physical views of system components.

Physical components are those that actually *physically* exist within the real world (or will exist in the future). They represent things, as they are, warts and all, complete with constraints imposed by organisational, political or technical factors. For example in the physical world, there may be two processes associated with producing an invoice; filling in the invoice details and calculating the invoice cost. The reason for the separation of the two tasks may be purely organisational, i.e. the job descriptions or policy in the accounts office dictate that one job holder (for example clerk) carries out the description task, and another (for example accounts supervisor) carries out the other. The fact is that there are two distinct *physical* processes.

Logical components are those that represent a picture of what underlies the physical components. In a sense they give a picture of what physical components would look like in an ideal environment, free from real world constraints. Using the invoice creation example from above, the logical view would be one of a single activity: creating the invoice. The fact that the process is split in reality is irrelevant; we are only carrying out one 'business' process.

Another example of physical and logical views of a system component might be the invoice itself. In physical terms we have a single object: the invoice. In logical terms we have information about several objects: the customer being invoiced; the items detailed in the invoice; the quantities and costs of each invoice line and of the total invoice.

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4.5 Overview of SSADM

SSADM consists of three main components:

- The default structure or framework of an SSADM project;
- A set of standard analysis and design techniques - The techniques are used to develop the products of an SSADM project;
- The products of each technique - Most Tasks create or enhance a standard SSADM product. At the end of an SSADM project the new system will be described by the sum of these products. An outline description of the products from each stage will be found in Appendix A.

This review has focused upon the structure and products of an SSADM project since the techniques are of secondary interest.

At the most detailed level, SSADM describes a large number of Tasks that may be undertaken during the project. These are structured into groups so that they can be planned and managed successfully and their progress monitored accurately. The lowest level grouping of interest to this review is the Stage. This structure is illustrated in Figure 4.2 below.

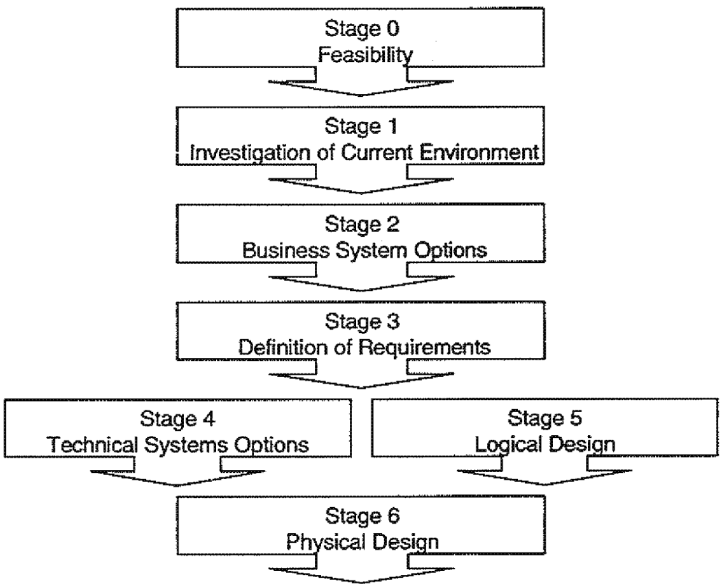

Figure 4.2 - The Stages of SSADM

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Stage 0 - Feasibility: The scope of the proposed IS project is **defined** using some of SSADM's core techniques to produce a high level overview of processing and data. Several options for taking the project forward to a full SSADM study are looked at and a single option is selected on the grounds of benefits versus costs. A decision to abandon the project might be taken if the project is found to be infeasible.

Stage 1 - Investigation of Current Environment: In many cases the new computerised information system will be intended as a replacement or extension of existing systems (which may be fully computerised, entirely manual, or a combination of the two). In this situation, the full analysis of requirements is begun by modelling the current system with a view to drawing out existing problems and new requirements.

Stage 2 - Business System Options: Stage 1 will have produced a reasonably comprehensive statement of user requirements. This is now examined and options for solving the business problem (or a subsection of the business problem) are assembled. Although some generic physical or technical aspects need to be taken into account, attention will be directed towards defining business (or logical) solutions, and not towards describing any specific technical environment. A single option will be selected as providing the shape and direction for detailed requirements specification.

Stage 3 - Definition of Requirements: Stage 3 lies at the heart of an SSADM project; it is where user requirements are transformed and refined into a detailed and precise specification of what the system is required to do.

Stage 4 - Technical System Options: Stage 4 is carried out in parallel with Stage 5 (Logical Design). The specification resulting from Stage 3 will provide the project team with enough information to propose alternative technical environments to implement the system design upon. In many cases the team will have no discretion in the choice of hardware and software, but where there is discretion the team can draw up several options for hardware, software and development platforms, and help management to select a single option for use in physical design.

Stage 5 - Logical Design: In Stage 5 the system design process is taken as far as is possible, without reference to a particular technical environment. The resulting design will be logical in nature and so capable of implementation on a variety of platforms. It will also act as a more or less permanent model of how the system satisfies user requirements. The logical nature of the design means that it should reflect underlying business rules and activities rather than physical constraints.

Stage 6 - Physical Design: The logical system design from Stage 5 is now translated into a physical design based on the technical environment selected in Stage 4. In many areas physical design is dependent directly on technical issues specific to the chosen environment. Consequently SSADM is only able to provide generic guidelines in these areas. In this way it covers most but not all of the systems design phase.

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4.6 SSADM Project Management

SSADM provides no specific project management activities of its own, but it does require the use of effective management procedures. At the end of most steps and stages SSADM will output a number of products for quality assurance and project control purposes. A structured project management method, such as the UK Government standard PRINCE/2, offers appropriate structure for the orderly management of projects. As part of the project management structure, SSADM assumes that a Project Board will exist to control and agree the decisions of the project team. This board should ideally be drawn from user and IS management.

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5 QUALITY ASSURANCE

5.1 Quality Assurance Methods

The purpose of quality assurance is to verify that the system is of acceptable quality. Most of the products from stages 0 to 6 of an SSADM project are recorded as documents. Review and comment is the main quality assurance method employed during these stages. The majority of Pathway documents we have examined appear to have been through an appropriate process of review.

However, the principle method used to ensure the quality of the software developed from the design specifications of stage 6 is testing. There are four distinct stages of testing:

- Program Testing
- System Testing
- Acceptance Testing
- Live Running

5.2 Program Testing

Each program and program component will be tested against its specification to ensure that it behaves according to that specification. A large number of test cases will be executed to ensure that each program handles not only the standard conditions and values that need to be processed but also the extreme and unusual conditions. It is particularly important to show that a program that interacts with the users of the system will deal successfully with data and conditions that are outside the expected range - it should reject the data indicating the reason for rejection rather than failing with a program error. When programs fail their tests, the code will be modified and the programs resubmitted for testing. Only when the programs have been successfully 'program tested' should they be submitted for inclusion in the next stage of testing.

5.3 System Testing

Sets of programs are assembled (a process often known as integration). The full system is then tested against the system's specification. Although individual programs may have been shown to work correctly through program testing, when working together they may behave in an unexpected way. This may be because the programs have been incorrectly coded, or more likely, the system design did not take certain conditions or data values into account.

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A substantial number of test cases will need to be constructed, and extensive planning performed, before system testing can begin. Where there is a significant on-line workload i.e. users at terminals or connected PCs, it is often necessary to use special software testing packages to simulate the large number of transactions expected during live running.

Errors detected at system testing are more expensive in time and effort to correct than those detected at program testing. More than one program may be affected by the change in design, with each having to be modified and re-tested. In addition, the system will need to be integrated again with system test cases - already executed successfully - re-run to ensure that changes made to the programs have not introduced new errors. Only when system testing has demonstrated that the system is of the required quality should it be released for acceptance testing.

5.4 Acceptance Testing

Unlike earlier testing, acceptance testing involves business users. Its primary aim is to demonstrate that program and system testing has been rigorous. To this end, a form of statistical sampling is often employed to select test cases. The test cases must be defined at the finest level of detail to ensure that business rules are followed precisely. If errors are discovered, additional test cases will be constructed to determine the extent to which system testing has failed in error detection.

Acceptance testing also provides the first opportunity to exercise, and possibly refine, business processes dependent upon the new IT systems facilities and to ensure that the processes and IT facilities integrate successfully.

Sometimes acceptance testing is used to demonstrate that the system successfully meets the business requirements as expressed in the requirements catalogue. However, if proper requirements analysis and specification has been performed prior to system design, this use of acceptance testing is not necessary. Business users will have ensured that the requirements analysis is a true expression of the business requirement and that the system's logical design meets the business' needs. Thus, if system testing has demonstrated that the system specification has been correctly implemented, acceptance testing should be no more than a short quality assurance exercise. However, if requirements analysis has been inadequate, acceptance testing must of necessity be an extended and expensive exercise with much system re-design, modification or addition of program code with all associated program and system testing repeated.

When a system is being procured from an outside supplier, acceptance testing is the usual method to ensure that the supplier has met the terms of the contract.

On successful completion of acceptance testing, the system can be released for live running.

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5.5 Live Running

Once the business starts to use the new system to support its processes, unexpected conditions come to light. These are circumstances that were not foreseen by the users or IT staff during the analysis and design of the system, despite the application of rigorous methods. Thus although not generally seen as such, live running forms the final cycle of testing.

Errors found during live running may only be corrected through a complete cycle of requirements definition, modification to the system design and the necessary program modifications. These changes must be followed by the appropriate program, system and acceptance tests to prove the changes work as intended, and have not caused other errors. The speed at which this must be done will depend upon the criticality of the error detected.

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6 PATHWAY'S APPROACH

6.1 Introduction

Figure 6.1 below shows the SSADM stages illustrated earlier. It also shows how the responsibilities for delivering the products of those stages were shared between the Authorities and Pathway.

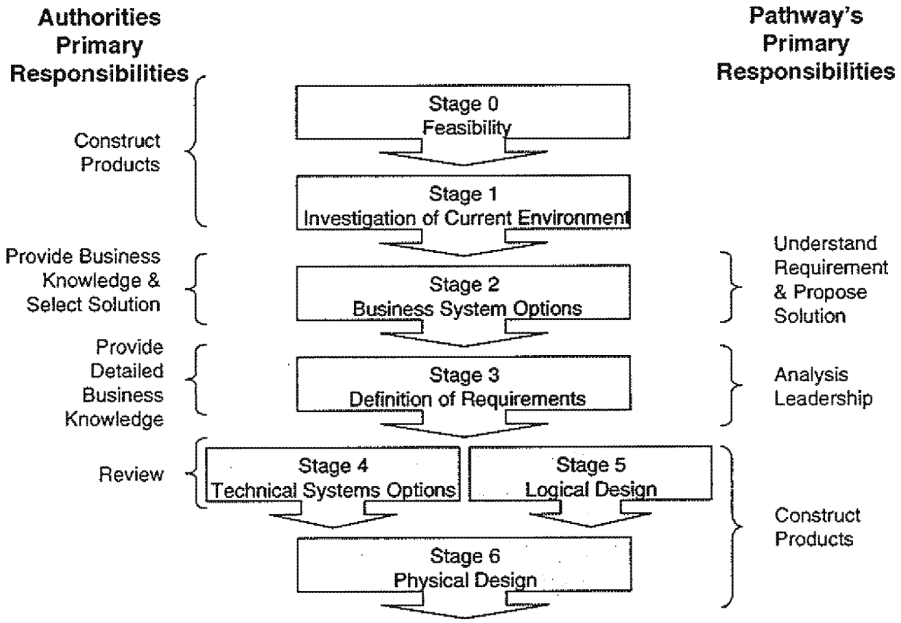

Figure 6.1 - SSADM Stage Responsibilities

The work performed by the Authorities during the period up to the publication of the Statement of Service Requirement (SSR) "*Bringing Technology to Post Offices and Benefit Payments: Statement of Service Requirement - March 1995 Final version 6*" [Ref. 3] was equivalent to SSADM stages 0 and 1 and was their sole responsibility.

Stage 2, in broad terms, was the period of demonstration, ITT production, vendor selection and contract production. The vendors each proposed a solution and the Authorities selected Pathway's. During this period Pathway had ample opportunity to clarify requirements to the degree necessary to design an appropriate solution and plan its development. Indeed, Pathway should have constructed, at a minimum, a first draft of the System Logical Data Model and the System Data Flow Model. This activity would have ensured that where Pathway did not understand the Authorities requirements it could have raised the appropriate questions. Without this definition of **what**

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was required it would not have been possible to identify the work required or produce a plan for completing the project.

The equivalent of SSADM Stage 3 began immediately after contract signing. This stage should have focused upon agreeing, in precise detail, what the Pathway service was to deliver. Pathway's responsibility was to ensure that it had a clear and precise definition of what the Authorities required, whereas the Authorities responsibility was to provide all necessary information in response to Pathway's request. Leadership should have come from Pathway since this stage requires techniques to be used which are IT specialist skills, rather than the business skills and knowledge held by the Authorities.

SSADM Stages 4, 5 and 6 are related to design and were, and still are, Pathway's responsibility since they are concerned with **how** the service is to be delivered. Pathway has been most insistent upon this point. The Authorities' responsibilities should have been limited to the review and approval of detailed design where it has a direct impact upon the Authorities - for example the appearance of the counter clerk's screen.

Successful completion of Pathway's design responsibilities was, and is, dependent upon the quality of the requirements specification produced during the period of the project equivalent to SSADM stage 3. We therefore focus upon that period, together with an assessment of the Quality Assurance applied by Pathway.

6.2 SSADM Stage 3 Primary Products

The primary products from this stage are:

- Detailed Required System Data Flow Model
- Detailed Required System Logical Data Model
- Detailed System Functions
- User Job Specifications
- Processing Specification
- Enhanced Requirements Catalogue

Because many IT development projects are tasked with replacing an existing IT system with a new one, the two systems are distinguished by the terms **current system** and **required system**. Stage 3 is focused upon the required system with its products named to reflect this distinction where necessary.

In the following sub-sections we present for each product:

- A description of the SSADM product and the main reasons for producing it. Each product can be composed of a number of sub-products. We have only presented this detail where it aids comparison.
- An outline of what has actually been produced during the project and how well this supports the underlying purpose of the SSADM product;
- The implication for the project of what has actually been produced.

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6.3 Detailed Required System Logical Data Model

6.3.1 Description

A Logical Data Model (LDM) describes in detail:

- the main objects of interest to the business, for example Outlets and Counter Clerks. These are termed business entity types;
- the attributes of interest for each entity type - for example the *Name & Address* of an Outlet and the *Identifier* of a Counter Clerk. The definition for each attribute includes the type of data - numeric, character, the length of the attribute, the range of values it can take, the meaning of coded values etc;
- the nature of relationships between entity types. For example an Outlet may have one or more Counter Clerks working at the Outlet and a Counter Clerk must work at one and only one Outlet.

Information on expected volumes of data is also held with the LDM. Once again, this will be important during the design process in ensuring performance targets are achieved.

The Detailed Required System LDM is a critical product of the development process. Indeed, it is generally considered to be the single most important product for ensuring a successful project outcome.

6.3.2 Actual Products

We can find no evidence of a Detailed Required System LDM, or equivalent, for the complete system. The POCL Reference Data LDM has been produced by POCL. Some part of this is implicitly included in the EPOSS logical data model. There is no LDM of the remainder of EPOSS. The Horizon library does not contain an LDM for BPS. It may be that CMS and PAS projects have developed one, however the documentation of those projects is not visible to the review team.

The full required system logical data model should have been reviewed and signed-off by the Authorities. This has not occurred.

6.3.3 Implications

Pathway will almost certainly have produced **physical** data models i.e. specifications of file and database records (products of later stages). However, these are not substitutes for an LDM since:

- Without a single reference description of each entity type and its attributes, it is likely that designers will produce different representations of the same entity types. This can lead to failure during formal testing or, if not detected, failures during live running;

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- The nature of relationships between entity types is not explicitly described. This makes it difficult for programs to police them and ensure that only valid relationships are recorded e.g. each Post Office **may be** the nominated Post Office **for one or more** Customers. However, each Customer **must have one and only one** nominated Post Office;
- Most systems hold more than one copy of information about each business entity; for example details of POCL products are held on the POCL Reference Data system, the Pathway Reference Data System and the EPOSS counter system. Without the LDM as a foundation for the physical design, it is difficult to identify where data is replicated and how consistency between multiple copies is being maintained.
- Business changes will occur that demand modifications or additions to data held on the system. Without the LDM the process of identifying the set of files and programs to be modified becomes significantly more difficult, and thus extends the time taken to implement the required business changes.

6.4 Detailed Required System Data Flow Model

6.4.1 Description

A Data Flow Model (DFM) illustrates the way in which data (or information) is passed around the system, and how it is transformed and stored within the system. A DFM is a set of diagrams and supporting text describing the following:

- **External Entities** - The people, organisations and other computer systems that act as sources of data to, or recipients of data from, the system - for example Counter Clerks, Help Desk staff and the CAPS system;
- **Processes** - These represent business activities carried out upon and triggered by data. They should not be confused with computer programs. A process may sometimes equate directly with a program, but even then will be defined in user, rather than computer, terms. In other words, it should reflect the business activity it supports;
- **Data Stores** - These are, as their name suggests, stores of data within the system. They may be computerised data stores or manual data stores (filing cabinets etc.);
- **Data Flows** - These are arrows which represent the flows of data to, from and within the system.

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The expected frequency of each type of event will also be recorded. This will be important during the design process in ensuring performance targets are achieved.

Stage 3 should produce a fully expanded data flow model. The lowest level (elementary) functions will be identified.

6.4.2 Actual Products

No Required System Data Flow Model or equivalent is recorded in the Horizon library. If Pathway had produced one it should have been reviewed and agreed by the Authorities to be a proper foundation for the following design stages. Indeed, it couldn't be produced without the business knowledge of Authorities staff. We have found no evidence that Pathway produced a Required System Data Flow Model.

6.4.3 Implications

Data Flow Modelling is a widely used and mature analysis technique, and can be found in most structured methods. A DFM and the related Logical Data Model are the foundation upon which a system is designed. Without this analysis, the designers are, at best, working in an inefficient manner, gathering detailed requirements from users in an ad-hoc way. At worst they are 'working in the dark', with their understanding - or more probably lack of understanding - not being revealed until testing of the system by the users.

6.5 Detailed System Functions

6.5.1 Description

Defines the **logical** functions that will be used when recording business 'events' (for example - Customer Presents New Card Pick Up Notice, Introduce New POCL Product, Balance Stock Unit etc.). Each functional description defines the logical data associated with the event type that will be passed across the user interface. The precise techniques used to describe the functions will depend upon the sophistication of the user interface (simple screen, windows interface etc.). The user roles applicable to each function are also defined. This is the first step in defining access rights for users.

The logical interfaces to other IT systems are also described (for example between CAPS and PAS).

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6.5.2 Actual Products

There are Pathway produced **physical** design specifications of system interfaces. These contain a mixture of the required logical information together with design detail not relevant to SSADM Stage 3. None of the design documents cross-reference documents containing purely 'logical' views. We conclude that the latter have not been produced.

6.5.3 Implications

Failure to consider the logical user interface prior to detailed design leads to:

- Decisions about the style of user interface being made before a complete understanding of what information is to be passed. As a result, design re-work is likely to be required (extending time-scales);
- Difficulty in separating the logical definition of user interfaces from the physical definition i.e. separating the 'what is to be done' from the 'how it is to be done'. This raises the risk of users missing important detail that will not be discovered until testing (extending project time-scales), or possibly not until live running (with potential business impact).

6.6 Processing Specification

6.6.1 Description

This is a precise and complete definition of the business rules for maintaining each entity type defined in the logical data model in response to each event type that drives the system. The specification must take into account **all** possible states of data and how it will be manipulated to comply with business rules. Computer programmers will encode these rules during the detailed design stages of the project. If there are gaps and inaccuracies in the specification, then these will be reflected in the implemented computer system.

Since the specification is the route by which the business users communicate the detailed business rules to computer programmers, it must be expressed in a way that is understandable to both groups. SSADM uses a range of diagrammatic techniques to define the processing specification. Some other methods use Structured English to the same effect.

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6.6.2 Actual Products

We have found no evidence that processing specifications have been produced. Only the SADD and a number of functional description documents (such as Foreign Encashments) have been produced by Pathway. Most have been signed-off by the Authorities. However, none of them are at a level of precision that achieves the objectives of a Processing Specification.

6.6.3 Implications

Pathway has produced computer programs without having an agreed logical processing specification in place. Which business rules have been implemented cannot be determined except by:

- Examining program specifications where they exist (Pathway do not make this information available to the Authorities);
- Examining program code where specifications do not exist or are inadequate detail (Pathway do not make this information available to the Authorities);
- Testing programs to see what they do.

Only the last option is open to the Authorities (see the following Chapter on the subject of Pathway's approach to Quality Assurance).

6.7 User Job Specifications

6.7.1 Description

A new IT system is usually developed hand-in-hand with changes to business processes. The User Job Specifications describe the required processes and the use made of the required IT system functions.

6.7.2 Actual Products

POCL Business Process Descriptions describe in diagrammatic form the process to be followed in outlets when handling 'business events'. However, as there is no definition of the IT system's functions available to us, we have no way of knowing if the POCL business processes will be adequately supported by the Pathway system.

The majority of changed BA business processes use the CAPS system for support, and their User Job Specifications are therefore not within the scope of this review.

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6.7.3 Implications

When the new business processes are tested with the IT system there is a significant risk that the two will be incompatible to some degree. Either the Authorities desired business processes will need to be modified to fit with the IT system or Pathway will need to change the IT system to properly support the new business processes. In either case, further delays and additional costs are likely.

6.8 Enhanced Requirements Catalogue

6.8.1 Description

Additional or clarified business requirements are often identified during the Requirements Specification stage of a project. These are added to the catalogue produced in the previous stages. The requirements are a mixture of **what** the new system must achieve in business terms and **constraints** on how the functionality is to be delivered (performance, reliability, availability etc.)

The catalogue will be used to check that the products produced in stages 3, 4 & 5 adequately address the business requirements.

6.8.2 Actual Products

The Authorities produced the Contract Requirements Catalogue. Pathway produced matching solutions, also recorded in the Contract. Many of the requirements are about the **service** rather than the **system**. We have focused upon system requirements.

The contract requirements catalogue contains a mixture of system requirement types. Some would normally be found in the SSADM catalogue. Others are of a more detailed nature and define business rules and would appear in other products from this SSADM stage. Overall, the catalogue is good at defining **what** is required without constraining Pathway in how the solution is to be delivered.

Controlled changes to the catalogue continue to be made as the Authorities requirements are clarified or amended, but there have been relatively few that affect the development of the system.

6.8.3 Implications

The few changes that have been needed to add to or clarify requirements related to the development of the system supports the view that the original statement of requirements was satisfactory. This refutes the Pathway allegation of changing requirements.

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6.9 Quality Assurance

6.9.1 Testing Stages

Testing the software to see if its behaviour corresponds with the relevant specification is the primary means of assuring quality. This applies to the individual programs that make up an IT system, as well as the complete IT system. There are four distinct stages of testing - program testing, system testing, acceptance testing, and live running. The testing terminology used within the Card Programme does not correspond precisely with this definition. From examination of the relevant documentation we conclude that the following table represents the equivalence between stages:

Typical Testing Stage	Card Programme Testing Stage
Program Testing	Program Testing
System Testing	Acceptance Testing
Acceptance Testing (1)	Model Office Testing
Acceptance Testing (2)	Live Trial
Live Running	Live Running

Table 6.1 - Testing Stages

6.9.2 Program Testing

We cannot comment directly upon Pathway's program testing since the relevant documentation is not open to our inspection. However, from documentation we have seen, we can infer what has happened in the past and predict what is likely to happen in the future.

Without a detailed requirements analysis, program specifications will contain errors and omissions. Therefore, no matter how good Pathway's program testing has been it is likely that programs will not meet the Authorities business requirements. This will not come to light until Acceptance Testing (Model Office & Live Trial). Further modification of Pathway's software will be required with resultant extension to time-scales.

6.9.3 System Testing - Card Programme Acceptance Testing

Acceptance testing is being used to demonstrate that the Pathway system meets the Authorities requirements as expressed in the contract requirements catalogue. Pathway has defined a series of Business Threads, the individual steps of which are used to exercise the system. The Threads represent potential business scenarios and

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test that the system successfully handles them. There is a separate acceptance test specification for each major functional area - BES, OBCS, APS etc. Each specification lists the set of requirements catalogue items relevant to the particular functional area and identifies the business threads that will be executed to demonstrate that each requirement has been successfully met.

The catalogue is not, however, a detailed system specification. This lack of detail means that acceptance testing against the catalogue alone cannot reveal the 'correctness' of the Pathway design. This is evidenced by the detail of the Model Office Testing, which goes far beyond the detail contained in the contractual requirements catalogue. As is the case for program testing, even exceptionally good system testing by Pathway will not, indeed cannot, detect a significant number of errors and omissions.

6.9.4 Acceptance Testing (1) - Card Programme Model Office Testing

We quote from the Horizon Test Team's Model Office Low Level Test Plan for Nile Release 2.0 [Ref. Horizon Test Team, Model Office Low Level Test Plan, BA/POCL Nile Release 2.0, Version 1.1, 5th August 1998]:

"The Model Office test phase will:

- *Focus on testing the alignment between the operating procedures and systems functionality*
- *Prove the interaction of procedures across all systems involved in Nile Release 2.0 for the first time*
- *Give assurance that the training provided to operators will be sufficient to use the Horizon system*
- *React and resolve incidents as per live operating procedures (i.e. via the various supporting Helpdesks)*

Conversely, it will not:

- *Attempt to prove functionality that has not already been proved in a prior phase of testing*
- *Focus on exceptional or contrived tests*
- *Attempt any excessive performance or volume testing"*

Model Office Testing is thus performing the classical role of acceptance testing by ensuring that the IT system will integrate with the new business processes and that selected users are well trained in its operation. It is also clear that Model Office testing pre-supposes that program and system testing has been rigorous and will therefore have included "exceptional" and "contrived" tests i.e. tested that the software can correctly handle all valid business conditions and, conversely, reject all invalid conditions.

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However, as we describe earlier, program and system testing will not have achieved this objective since no full analysis of the Authorities business rules has been produced. Thus testing the system's capability for handling exceptional conditions will not be performed until Live Trial and Live Running.

6.9.5 Acceptance Testing (2) - Card Programme Live Trial

Whilst still part of the contractual acceptance process, Live Trial is, in reality, Live Running, albeit at a limited number of offices for a limited set of benefits.

6.9.6 Live Running

The great majority of transactions performed during Live Running will be 'run of the mill' transactions which have been thoroughly exercised in earlier phases of testing. These should be processed correctly.

However, Live Running, because of its scale and the diversity of business situations, will reveal errors and omissions within the Pathway system with unpredictable results.

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A. APPENDIX - SSADM DELIVERABLES

SSADM stage	Primary SSADM Products
0. Feasibility Study	• *Overview Data Flow Model* - an outline description of the selected functional areas of the business. Defines the scope. • *Overview Logical Data Model* - the equivalent logical data model. Main business objects identified but attributes not defined. Once again, defines scope. • *1st Cut Requirements Catalogue* - Gathers together the views of business users on what a new system should address, for example what is missing from current facilities, what is good about current facilities, expected changes to business activity etc. • *Feasibility Evaluation* - Cost benefit evaluation of possible solutions. Will contain an outline development plan. May recommend abandonment if project is found to be unfeasible.
1. Investigation of Current Environment	• *Business Activity Model* - A more detailed investigation of the activities performed in the business. Allows the scope to be clarified. • *Work Practice Model* - identifies who does what in the organisation. • *Enhanced Requirements Catalogue* - detailed investigations will reveal additional catalogue items. • *Current Physical Data Flow Model* - what goes on now in terms of the main processes • *Current Environment Logical Data Model* • *Current Services Description*
2. Business System Options	• *Business System Options* • *Selected Business System Option*
3. Requirements Specification	• *Detailed Required System Data Flow Model* - a fully expanded data flow model. The lowest level (elementary) functions are identified. Shows how all the required processes will interact with each other and which external events drive the system. • *Detailed Required System Logical Data Model* - provides a complete definition of every entity, attribute and relationship in the business data model to be supported by the new system.

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- *Detailed System Functions* - defines the functions that will be made available to users, and the user roles applicable to each function. It also describes the interfaces to other systems. It is the logical view of the all interfaces to the system
- *User Job Specifications* - the new IT system will be developed hand-in-hand with changes to business processes. These specifications describe the required processes and the use made of the required system functions.
- *Processing Specification* - a precise and complete definition of the rules for maintaining the data defined in the logical data model in response to each event that drives the system.
- *Enhanced Requirements Catalogue* - additional or clarified business requirements are often identified during this stage. These are added to the catalogue produced in the previous stage.

4. Technical System Options

- *Technical Systems Options* - the Requirements Specification stage will have revealed additional detail such that a number of options for physical design will need to be considered and one selected to be carried forward.
- *Outline Technical System Architecture* - describes how the selected system will operate.
- *System Description* - describes the functionality in the Requirements Specification that is to be implemented in the selected system.
- *Impact Analysis* - explains the impact of the selected option on the organisation.
- *Outline Development Plan* - an overview plan for the remainder of the project.
- *Cost/Benefit Analysis* - will allow for the justification or rejection of various components of the selected option.
- *Workload Model* - An assessment of how the selected system will support the expected workload. Allows capacity planning to be performed.
- *Application Style Guide* - defines standards for the user interface so that a consistent look and feel will be implemented across the system.

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5. Logical Design	• *Dialogue Design* - defines the detailed logical structure of the user interface dialogues i.e. the structure of the interaction between user and system. • *Conceptual Process Models* - only required for complex update and enquiry processes.
6. Physical Design	• *Application Development Standards* • *Physical Data Design* • *Function Specification* • *Space & Timing Estimates*

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DOCUMENT CONTROL

Change History

Version	Date	Status	Purpose
1.1	19/2/1999	Draft	An incomplete draft for review by Project Mentors team.
1.2	25/2/1999	Draft	A complete draft for review by Project Mentors team.
1.3	5/3/1999	Draft	A complete draft incorporating comments from previous review. For further comment by Project Mentors team.
1.4	11/3/1999	Draft	Incorporates comments from review by Project Mentors Team. Includes additional detail on quality assurance. For review by team.
1.5	22/3/1999	Draft	Further draft incorporating comments from review on 17/3/99.
1.6	30/3/1999	Draft	Management Summary added plus additional comment incorporated. For review by team on 31/3/99.
1.7	1/4/1999	Draft	Introduction modified to be consistent with other reports. Changes to layout made for consistency. Minor modifications following review comments.
1.8	9/4/1999	Provisional	Incorporates minor modifications to text and layout.
1.9	27/4/1999	Provisional	Incorporates further minor modifications to text and layout.

Changes Forecast

This document version will be presented to Bird & Bird for review. This may result in further modifications.

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Distribution

Project Mentors	Bird & Bird	Benefits Agency	POCL
Andrew Davies	Hamish Sandison		
Andy Wing			

References

1. Report: Pathway Systems Development Project - Requirements Review, Project Mentors document A.41.07
2. Report: Pathway Systems Development Project - Project Management, Project Mentors document A.41.05
3. Bringing Technology to Post Offices and Benefit Payments: Statement of Service Requirement - March 1995 Final version 6
4. Horizon Test Team, Model Office Low Level Test Plan, BA/POCL Nile Release 2.0, Version 1.1, 5th August 1998

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April 28, 1999

Mr. Hamish Sandison
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Dear Hamish,

Independent Consultant Review of BA/POCL Payment Card programme
Privileged and confidential. Prepared in contemplation of litigation

We have now completed production of the full set of reports on the Pathway Systems Development Project, as described in my letter of 23rd March. I therefore enclose 1 bound and 1 unbound copy of the following:

A.41.05 Project Management
A.41.06 Systems Development Approach
A.41.07 Requirements Review

The summary report, A.41.08 Management Summary, was sent to you last week.

Our team will complete the indexing and filing of documentation this week and next, at which time they will have no further work to carry out for the programme. Unless I hear to the contrary, they will then be assigned to other projects.

We will, of course, be available to present our conclusions to you and the Authorities. I will contact you to discuss arrangements for such presentations.

Yours sincerely,

GRO

Professor Andrew Davies
Director

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REPORT
PATHWAY SYSTEMS DEVELOPMENT PROJECT
PROJECT MANAGEMENT

Ref: **A.41.05 Version 2.1**
Status: **Provisional**
Prepared: **April 1999**

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Expert review of BA/POCL Payment Card Programme
Pathway Systems Development Project - Project Management

SECTION **PAGE**

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1. INTRODUCTION

1.1. Context

This report is one of a set of related reports commissioned to support potential litigation and negotiations for settlement of that litigation with respect to the Card Payment Programme. The structure of this set of related reports is illustrated in figure 1.1 below, which highlights the position of this report within that structure.

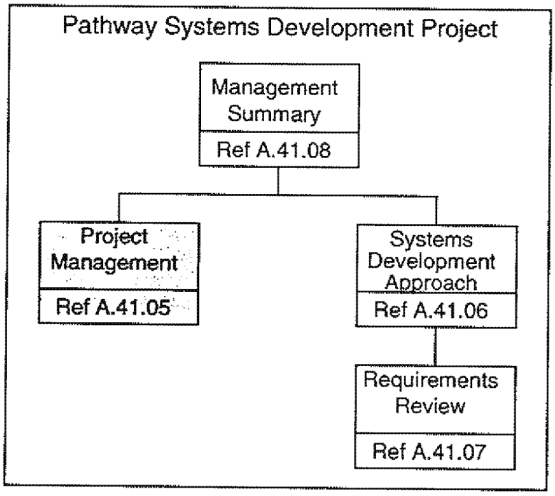

Figure 1.1 - Structure of Related Reports

This report describes our findings with respect to Pathway's management of the project, while the *"Systems Development Approach"* [Ref. A.41.06] and *"Requirements Review"* [Ref. A.41.07] reports set out our assessment of the technical aspects of Pathway's development of the system. The overall findings of our review are set out in *"Pathway Systems Development Project - Management Summary"* [Ref. A.41.08].

It should be noted that there are links between the management and technical factors, and ideally this project management report should be read in conjunction with its companion papers.

1.2. Scope of this Report

The Card Payment Programme calls for the provision of a wide range of **services** by the CONTRACTOR (Pathway Ltd.) for the Benefits Agency (BA) of the Department of Social Security (DSS) and Post Office Counters Limited (POCL). Three related agreements define the rights and obligations of the parties in providing these services. The agreements are between Pathway and the DSS and POCL jointly (the Authorities agreement) and between Pathway and the DSS and between Pathway and POCL.

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The services to be supplied under the agreements are Development Services, Rollout Services, Steady State Services, Management Services, Contingency Services and Transfer Services. This report, and its companions, are concerned only with the development services, which include:

- PAS - Payment Authorisation Service;
- CMS - Card Management Service;
- BES - Benefit Encashment Service;
- APS - Automated Payments Service;
- EPOSS - Electronic Point of Sale Service.

A number of other development services are identified in the relevant agreements or schedules to those agreements as contingency, optional or additional services. Apart from the Order Book Control Service (OBCS), which is a POCL optional service, none have been covered in this review.

The services could not be supplied in any way which met the expressed requirements of the Authorities without the support of computer based systems. Therefore the systems are fundamental to the services provision. The related agreements clearly place responsibility with Pathway for the provision of these systems, together with the necessary interfaces between them and with other DSS and POCL systems. Appendix A to this report lists the relevant clauses and schedules supporting this allocation of responsibility.

Under the related agreements, Pathway has the authority to determine whether each system can be an existing (packaged) system, a modified package or be developed from scratch. However, whichever route is chosen, the end results must meet the requirements of the Authorities and support the solution defined by Pathway.

We describe the provision of these systems as the development project, shortened to the **project**, in contrast to the overall provision of the services which depend on them. The systems which the project will provide we have collectively called the **system**. We have not reviewed the service provision aspects of the Card Payment Programme because the system has yet to be completed.

1.3. Purpose

This report has been commissioned to support potential litigation and negotiations for settlement of that litigation. It therefore aims to provide negotiators, who may not be wholly familiar with IT developments, with an assessment of Pathway's performance in this area.

Because the report may be used by people without a systems background, we have striven to provide a view which we trust will be readily comprehensible, and have, as far as possible, avoided the use of IT jargon. This applies particularly to Chapters 3 and 4 which outline, respectively, why project management is necessary and what is accepted good project management practice. The concepts described in this report need to be understood if the scale and impact of failures in following good project management practice are to be recognised.

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1.4. Constraints

Currently (April 1999) we do not have access to Pathway documents or to its staff. In consequence, our findings are based on:

- relevant items in the Authorities possession;
- the absence of material which it might reasonably be expected Pathway would have prepared and passed to the Authorities;
- our assessment of the causes behind various events in the project's history.

1.5. Definitions

There are a number of terms used throughout this document and its companion reports which can have different meanings in different contexts. We have defined our use of these terms at Appendix B.

1.6. Document Structure

The next Chapter summarises our overall findings on Pathway's project management performance. Following the Summary, we set out an overview of what constitutes a project, how project based activities differ from on-going activities, and why it is so crucial that effective management is applied to projects.

We have then presented a very brief overview of one particular project management approach, known as PRINCE/2. This is offered as a representative and well documented standard against which Pathway's performance can be assessed.

Next we have described the way in which we have compared Pathway's project management against good practice, also providing more details of the context of this review. The following Chapter sets out the findings of our review of Pathway's project planning, relating these to the various replanning exercises which have taken place during the life of the project. The final Chapter sets out our findings on Pathway performance with respect to project controls, risk and quality management.

The body of the report is supported by two Appendices. The first lists the clauses and schedules in the Authorities, DSS and POCL agreements (the related agreements) which set out Pathway's responsibility for the development project and its management. The second contains definitions of technical terms.

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2. MANAGEMENT SUMMARY

2.1. Pathway's Responsibilities

At the outset of our work we reviewed the contractual documentation to determine whether Pathway was responsible for:

- developing the software for the Card Payment programme;
- managing that development.

In our opinion Pathway was responsible for both aspects. We further identified that under the related agreements (clause 702.2), Pathway was obliged to apply good industry practice to all work in managing and effecting development of the software. Pathway, in its response to the Authorities Statement of Service Requirements, proposed the use of the PRINCE methodology for project management.

2.2. Good Practice

Managing projects in software development is one of the key factors in achieving the benefits expected from them. From the early days of computing, increased understanding gained from successes and failures has led to formal approaches to project management. While different approaches lay emphasis on different aspects, all recognise the need for projects to be properly organised, planned and controlled. They also endorse the necessity for managing the risks associated with development, and for ensuring that an appropriate degree of quality is maintained. From the late 1970's to the present day, formal approaches to project management have evolved from the use of standard checklists to the availability of methodologies. In our opinion, current good practice in software development demands the application of a methodology.

2.3. Assessing Pathway's Approach

Having established that Pathway was responsible for managing the software development in accordance with good industry practice, we chose the PRINCE/2 methodology as the standard against which to measure its performance. PRINCE/2 is the successor to PRINCE, which Pathway had proposed to use. It is in the public domain, and was available before the award of contract in May 1996. PRINCE/2 is less prescriptive than PRINCE, allowing the project manager to be flexible in choosing how its eight fundamental components are adopted. However, the requirements of those eight components must be met.

We had no direct access to Pathway's documents, nor the opportunity to hold discussions with its staff. Because of this we based our assessment on documents in the Authorities possession, supplemented by discussions with staff from BA and POCL. This has restricted our review to planning, controls, quality and risk management, four of the eight PRINCE/2 components. We were not able to assess organisation or the sub-division of the project into management stages. We could not directly assess configuration management or change control, although we consider that appropriate measures were in place for these aspects.

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We reviewed the events of the project from the issue of the Statement of Service Requirements through to and including April 1999. Our work concentrated on the planning component, the most critical aspect of PRINCE/2, and indeed of other methodologies. For planning we formed a view on what actually happened, as opposed to what might have been expected under PRINCE/2, at each point where the project was replanned. For the other three components we have drawn our conclusions from an overall project view.

2.4. Conclusions

It is our view that for the first eighteen months of the Card Payment programme Pathway failed to meet its obligations to use good industry practice in managing the software development project. In particular we conclude that Pathway:

- had no plan even approximating to the requirements of PRINCE/2 prior to the award of contract;
- failed to develop a realistic plan shortly after award of contract;
- again failed to develop realistic plans during the replanning activity of February 1997;
- did not prepare plans consistent with good project management practice until early in 1998;
- failed to control the project from its commencement until Pathway's project management improved early in 1998;
- did not address the need for risk and quality management in the first 18 months of the project.

We believe most of the project management problems stem from Pathway's failure to undertake a detailed analysis of the Authorities requirements. This lack of requirements analysis is set out in more detail in our report *"Pathway Systems Development Project - Systems Development Approach"* [Ref. A.41.06]. However, had Pathway attempted to develop a good project plan before or even shortly after contract award, the need for requirements analysis would have become apparent.

From late in 1997 or early in 1998, Pathway's project management approach started to improve. We believe, but would need access to Pathway's records to confirm, that Pathway is now applying most of the principles of PRINCE/2 to its management of the project. We do however remain concerned that there appear to be no detailed plans in place for the development of software deliveries after New Release 2.

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2.5. Impacts - To Date

Pathway's early failure to plan and control its software development project, together with its lack of application of risk and quality management measures, have had severe and adverse impacts on the Authorities. The impacts are those resulting from delays, and those resulting from the phasing of software delivery.

2.5.1. Delays

It now seems possible that New Release 2 may start rollout on a national basis in August 1999. This is just over two years later than envisaged when the contract was awarded. It must also be borne in mind that New Release 2 will not contain all the functions originally intended. The balance is to be made up in New Release 2+, which it is hoped will be available for national use from February 2000. This represents a delay of two years and seven months from the date expected at contract award, and a full two years later than was agreed during the replanning of February 1997. We have not yet seen detailed plans for the development of New Release 2+, making it difficult to place reliance on its being delivered for use in February 2000.

These delays have cost the Authorities substantial sums. The benefits expected from the system have not been achieved, and the Authorities have had to keep their own programme management and technical staff in place for much longer than anticipated.

2.5.2. Phasing of Software Delivery

Apart from an initial, very limited, release, the software was to be supplied as a single delivery in July 1997, followed three months later by a further delivery of additional functionality. Pathway encountered development problems towards the end of 1996 and proposed that the software be delivered as a series of releases. The Authorities accepted this proposal. Each extra release has and will require the Authorities to provide staff and facilities to test it, increasing their costs substantially.

2.6. Impacts - In the Future

As we have stated in 2.4 above, Pathway's management of the development project seems to have improved. However, we are concerned that there are no detailed plans available for New Release 2+ or for later releases. While we understand there are commercial issues around the content of New Release 2+, we would have expected there to be quite detailed plans for its development, albeit hedged with commercial caveats.

Assuming the present release does commence national rollout in August 1999, we believe there are risks that:

- planning for the next and subsequent releases may be obscured by the desire to rollout New Release 2;

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- if, as is quite possible, technical problems arise as the number of outlets using the system grows, Pathway may focus on the need for technical 'fixes' to keep rollout on schedule. Without firm project management disciplines, Pathway may lose sight of the need to manage development of subsequent releases.

To help manage these risks we recommend that the Authorities ensure Pathway apply good industry practice in its management of the project. Clause 5 of schedule A2 to the related agreements appears to give the Authorities the opportunity to monitor Pathway's Quality Management System through third party assessment. They may wish to consider making more active use of this provision.

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3. CHARACTERISTICS OF A PROJECT

3.1. What is a Project?

Projects originate with a desire for change. This desire may arise from competitive, regulatory or legislative pressure, from a wish to offer better customer service, to achieve savings in costs or a combination of some or all of these.

A project may be defined as an endeavour to achieve a specific goal in a pre-determined time. When that goal is achieved, or proves unachievable (at all or within the time allowed), the project terminates.

By nature, projects are 'one off' exercises. In this they may be contrasted with commercial activity based on continuing operations. For example, a manufacturing company will be concerned with taking in raw materials and possibly sub-assemblies, applying industrial processes to these, and producing finished products for sale to its customers. While the volume of such activity may rise and fall with the company's fortunes and general economic cycles, the principal business remains unchanged from one year to the next.

Both projects and on-going operations may be said to take inputs, apply a process and generate outputs. However, the nature of projects are such that each one will have different inputs and produce a different result. This requires that the process is well chosen and offers the best chance of success. Without a good process there can be no certainty that the desired result is achieved. This is illustrated in table 3.1 below.

	Inputs	Process	Outputs
On-going	Real things (raw materials, sub-assemblies)	Clearly defined (machine/chemical processes, labour operations)	Clearly defined (finished products for sale, sub-assemblies)
Project	Intangibles (concepts, ideas)	Good practice (Varies depending on inputs and outputs)	Variable (depend on inputs, technology, cost)

Table 3.1 - On-going versus Project Activity

3.2. Why Manage Projects?

Projects do not exist in a vacuum. Each is initiated by an organisation (company, Government Department) which funds the work of the project team in order to achieve the requisite results. In these circumstances the initiating organisation is the *customer*, and the project team is the *supplier*.

The customer will want to know from time to time what progress is being made on the project he or she is paying for. After all, if problems are encountered, it may well be better to abandon the work and write off the costs incurred to date than to proceed and incur further costs. This decision is the customer's prerogative.

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The supplier needs to know what progress is being made, whether the project is going to be completed on time and within budget, and if not what the overrun (or underrun) is going to be. The supplier also needs to know if the customer's requirements change during the course of the project for whatever reason.

The process of supervising all the activities on a project is *project management*. To ensure that such activity is both focused and accountable, a *project manager* is appointed. This person must have the experience and skills appropriate to the size and complexity of the undertaking.

3.3. Key Elements to be Managed

The fundamental role of the project manager is to deliver the required product to the customer at the agreed time. To do this he or she needs to put in place:

- a suitable project organisation;
- plans for the project;
- controls to monitor progress against the plans;
- management review and decision points;
- procedures to identify and control the risks to the project;
- ways to make sure that the quality of the final result is satisfactory;
- management of the products which the project produces, including both interim and final products. These are the assets that the project builds, and their control is generally termed configuration management;
- controls to ensure that any necessary changes are documented and controlled.

These factors are common to the major project management methodologies. We set out in the next Chapter why these factors are important, and explain how the PRINCE/2 methodology provides for them.

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4. THE PRINCE/2 METHODOLOGY

4.1. Introduction

There are a number of methodologies available as standard approaches for project management. We have elected to use PRINCE/2 to illustrate good practice in this area for three main reasons:

- it is widely used in public and private organisations within the UK;
- the methodology is in the public domain (although a registered trademark of the Government's Central Computer and Telecommunications Agency (CCTA)), and thus freely available;
- Pathway proposed the use of PRINCE, the forerunner to PRINCE/2, in its document *"Pathway Response to OJEC Notice 94/S 165-58937/EN"* (the Pathway Proposal).

PRINCE/2 is a development of PRINCE, the project management approach established in 1989 by CCTA. PRINCE itself was based on a commercially developed methodology named PROMPT which was created in 1975. Thus at the time the Card Payment Programme was starting, PRINCE/2 and its forebears had been in existence for 20 years.

PRINCE/2 is designed to support the management of the specification, design, development, testing and implementation phases of projects, to deliver a defined set of 'products'. For systems development projects, these phases are known collectively as the Systems Development Life Cycle (SDLC). The SDLC is preceded by the ideas/concept/feasibility stages and followed by usage and eventual discontinuance of the products.

PRINCE/2 has eight major components, as shown in figure 4.1 below, and the following sections set out an overview of each component.

Figure 4.1 - PRINCE/2 Components

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4.2. Organisation

4.2.1. Why have a Project Organisation?

A formal organisation structure provides clarity of responsibility within the group charged with the work, and accountability to those for whom it is being carried out. A suitable organisation:

- provides clear lines of communication between groups;
- allows individuals to fit into roles appropriate for their experience and abilities;
- enables those who have an interest in the outcome of the project to be involved with it without being full time members of the project team.

4.2.2. PRINCE/2 Project Management Structure

The project management organisation structure recommended by PRINCE/2 is illustrated in figure 4.2 below.

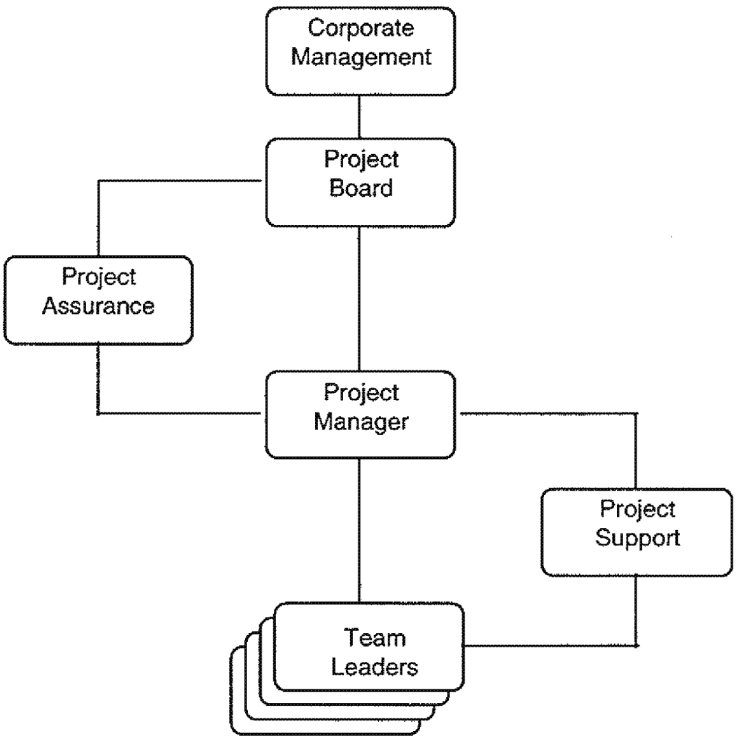

Figure 4.2 - PRINCE/2 Project Management Structure

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The methodology recognises that the organisation must contain a number of key roles. These roles can be assigned to specific individuals or groups. On smaller projects, one individual may undertake more than one role. The key point is that the roles are needed and must be fulfilled. The following points explain the roles in more detail.

Corporate Management - is outside the scope of PRINCE/2. It represents the senior management level in the organisation which determines the benefits required from the project, and which authorises the Project Board to expend the necessary resources to achieve them.

Project Board. The purpose of the Project Board is to represent the interests of the overall business, the users of the system and the supplier of the system. The Board has the responsibility for ensuring that the project stays on course and delivers the requisite products at an acceptable level of quality.

Members of the Project Board will be senior managers with the authority to commit resources to the project. They are most unlikely to be full time members of the project team. For this reason they must manage by exception, responding to deviations from plan and business and project issues as they are advised by the project team.

There are three key roles which must be fulfilled within the Project Board:

- executive;
- senior user;
- senior supplier.

The executive bears final accountability for the project. The role maintains a balance between the business, user and supplier positions during the project, and ensure that a 'value for money' approach is maintained. A further responsibility is ensuring that the integrity of the original business case for the project is maintained.

The senior user role, which may well require one or more individuals to represent a number of different groups of users, is concerned with making sure that the final product is fit for its intended purpose. The role extends to allocating user resources to the project, and to making sure that interim products are of sufficient quality.

The senior supplier role is there to ensure that the design and development approaches are realistic, and to represent those concerned with the design, development, testing and implementation of the product. Where the supplier side of the project has its own business case, the senior supplier role is also responsible for maintaining the integrity of that case.

Project Manager. Projects start with the production of a Project Initiation Document (PID) which defines the scope of the project. This is approved by the Project Board and day to day management of all the activities required to complete the project are assigned to the project manager.

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The project manager's role is to ensure that the work results in the agreed product on time and budget to an acceptable level of quality. This encompasses responsibility for making sure the project achieves the benefits originally foreseen.

Team Leaders. For all but the smallest projects, the project manager requires assistance. It is normal therefore to appoint team leaders to manage specific areas of the project. Team leaders are responsible for making sure specific products, as allocated to them by the project manager, are developed on time, to budget and to an agreed level of quality.

Project Assurance. The project manager has day to day responsibility for the project, including time, cost, resource and quality matters. Without independent verification, the Project Board has no way of telling whether or not reports from the project manager accurately represent the status of the project. The role of the project assurance group is to provide an independent channel of verification to the Project Board that all is well with the project.

Project Support. The project manager has responsibilities in a large number of areas. Monitoring these soon becomes time consuming and burdensome. The role of project support is to undertake the routine administration of such areas as maintaining the project plans, recording changes and managing the configuration of the products.

4.3. Planning

4.3.1. Why Plan?

There are two key aspects to project plans, the activity of planning and the plans themselves. During the World War II preparations for the "D" Day invasion of France, General Eisenhower is said to have remarked *"Plans are useless, Planning is essential"*.

The second part of this remark *("...Planning is essential)* stresses that the actual process of defining a plan is vital to an enterprise, because it makes the planning team think through every activity in detail. Having thought through the endeavour, a plan of how things should happen can then be drawn up to communicate with all involved what they have to do and when.

The first part of the remark *("Plans are useless")* reflects the fact that things go differently in the event from the way they were planned. However, without the initial plan, it is impossible to determine how far from that plan events have strayed.

The plan provides a route map through the project. By looking at signposts along the way, the project team, principally the project manager, can determine how far off-track they are, and from this work out the best route to getting back on track. Without a plan the team never knows whether it is on the right route.

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Project plans are absolutely fundamental to achieving success with the project because they afford the means of implementing progress measurement and corrective actions. They are absolutely central to any methodical approach to managing projects. A plan may be defined as a document defining how a specified target is to be reached, when it will be reached and who will be needed to reach it. By defining the how, when and who, the elements of cost, time scale and quality can also be addressed.

4.3.2. PRINCE/2 Planning

A plan sets out unequivocally:

- all the products to be produced to reach the desired aim, including intermediate products along the route;
- for each product, both the direct work activities needed to develop that product and the indirect activities needed to ensure that it is of acceptable quality;
- the estimated work involved in each direct and indirect activity;
- the resources required to complete the work, together with the skills required by the people involved;
- dependencies between activities within the project;
- dependencies on the delivery of such things as information, products and services from outside the project (external dependencies);
- the timing of the start and completion of each activity;
- points at which progress can be monitored and controlled;
- risks to the project and measures to avoid, mitigate or eliminate them.

A PRINCE/2 plan is more than a schedule of activities. It provides the reader with key information in a readily understandable way so that it can be assessed, questioned and confirmed.

4.3.3. PRINCE/2 Planning Levels

PRINCE/2 has two primary levels of planning, a *project plan* which is maintained at a higher level (less detail) than *stage plans*.

A project plan is needed from the outset, but there will normally be insufficient certainty to prepare a detailed plan at the beginning. It must therefore present the best available estimates of the likely future course of the project, and must state any assumptions made in its preparation. The project plan is the standard by which the Project Board assesses progress.

Under PRINCE/2, all projects are divided into manageable stages. A stage plan is required before work commences on each stage, and must be prepared at a very detailed level. The stage plan is the standard against which the project manager assesses progress.

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The project and stage plans can be further sub-divided where the size or complexity of the project warrants this. PRINCE/2 has the concept of *team* plans which are used by team managers to monitor progress of their teams' activities. Where team plans are used, the stage plan is a consolidation of its subsidiary team plans.

PRINCE/2 has one further, very important, type of plan, the *exception* plan. These are to be produced when it becomes apparent that a team, stage or project plan is not going to be achieved within its constraints. The exception plan, which has the same format as the plan it replaces, uses actual data on the activities of the original plan up to the point where the exception plan takes over, and then re-forecasts the details needed to complete the activities. It will also explain the reasons for the deviations, what will happen if nothing is done, any other options which may be available, and the impact on the project and business case. Exception plans must, if they impact the project plan, be approved by the Project Board.

4.4. Controls

4.4.1. What are Controls?

Once plans are in place, progress can be assessed and reported in terms of deviations from those plans. Any activities which are in line with their planned schedules can quite rightly be assumed to be of no danger to the achievement of the desired result on time. If the plan had a particular activity starting within a range of dates and completing within a later range of dates, then provided that activity is still within those boundaries it gives no cause for concern.

Controls are concerned with measuring how close the project is to its planned schedule. They are necessary to enable management to be sure that the correct products, with the right level of quality, are being produced on schedule and within the agreed cost and resource constraints, and that the business case remains viable. They provide the information by which each level in the project management hierarchy can:

- monitor progress;
- compare achievement with plan;
- detect problems and initiate corrective actions as early as possible;
- authorise further work.

The controls used must also monitor external events which impact on the project.

4.4.2. Controls in PRINCE/2

Most of the controls within PRINCE/2 are driven by events, such as the start or end of a stage, the delivery of a product or something similar. There is also provision for time driven controls, such as regular progress reports.

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At the Project Board level, controls are exercised on the basis of management by exception. That is the future work is planned, and most reporting is based on exceptions against that plan, for example the late completion of a stage or increased resource requirements. As long as the project progresses within its planned parameters, the Project Board need not intervene.

The main controls available to the Project Board are:

- the project initiation process, which is determines the organisation of the project, provides plans for the project initiation phase and starts to develop a formal project brief;
- an assessment of the status of the project at the end of each stage. This is to determine if the stage has been successful, if the project is still on course and will meet the needs of the business case, and if risks are being contained. This offers the opportunity to reorganise, or even cancel, the later stages of the project;
- regular 'highlights' reports on progress, issues and risks;
- exception reports which provide the earliest possible warning of deviations and put forward the options available for continuance;
- where deviations are foreseen, a mid stage assessment may be made to enable the Project Board to consider what actions can be taken;
- at the end of the project, a project closure process to check that everything required has been delivered, to determine if any follow-on actions are required, and to record 'lessons learned' as input to the planning process for future projects.

The Project Board is also responsible for monitoring events external to the project, and ensuring that the project team are advised of any changes arising from such external factors. Such items are normally communicated via the project manager.

The project manager exercises day to day control of the project within an authorised stage of the work. Provided they do not exceed the constraints set by the Project Board and the business case, the project manager can make detailed adjustments to the project as necessary. A large part of the manager's control mechanism is *work package authorisation*. This is a mechanism used to allocate work to individuals or teams in a way which clearly sets out the controls they are expected to apply on quality, time and cost, and the requirements for progress reporting and hand over of completed products.

4.5. Management Review and Decision Points

4.5.1. Why have Management Review and Decision Points

It is all too easy for projects to take on 'a life of their own'. They can become introverted, with the project team focusing on solving the project's problems, and ignoring the very business context which brought the project into being.

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To avoid this, it is necessary for the sponsors of the project to insist that its achievements and future plans are reviewed at pre-set intervals, and not allowed to proceed unless they are satisfied the project remains worthwhile.

4.5.2. PRINCE/2 Stages

PRINCE/2 divides a project into a series of *management stages*, which identify management decision points. Such management stages should not be confused with technical stages such as the specification of a system or the development of the software, as such technical stages do not necessarily correspond to business decision points. Dividing the project into management stages gives control to the business by allowing the Project Board to assess progress and determine the future at key decision points according to the business needs.

By reviewing the project at the end of each stage, the Project Board can, indeed is forced to:

- assess the viability of the project at regular intervals, and thus avoid its continuance if it is not going to meet the business needs;
- ensure that key decisions are made before the detailed work necessary to implement them is committed;
- clarify for the project what the impact of external events, such as legislation or budget constraints, will have.

As each stage is completed, more detailed knowledge of what is needed for the next stage becomes available. Thus more detailed plans for the next stage can be developed with greater certainty, and any impact on the viability of the overall project clarified.

4.6. Risk Management

4.6.1. Why Manage Risks?

All projects have risks associated with them. By their very nature projects are instruments of change, and there can be no guarantee at the outset that the change is achievable at all or within time and cost constraints. There are particular risks with IS projects which plan to use advanced technology. The technology may not work as expected, or performance may prove inadequate for the task. Outside factors may also present risks to a project, including such things as;

- the actions of competitors;
- legislative change;
- evolution (or revolution!) in the marketplace;
- changes in customer or supplier management or strategic objectives.

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The aim of risk management is to attempt to identify such factors, and determine and implement actions which can either eliminate them altogether or reduce the impact of such risks if they do occur.

4.6.2. Risk Management under PRINCE/2

The methodology defines risk as "*the chance of exposure to the adverse consequences of future events*". It accepts that controlling and containing risk is a key factor in making a project successful, and is thus a major element in project management.

PRINCE/2 identifies two main types of risk:

- **business risks**, which are the threats which can prevent the project from delivering the products or services which will achieve the planned business benefits;
- **project risks** are those which threaten the orderly management of the project, and in consequence the achievement of the project's end results within the agreed time and cost constraints.

Managing these risks is a key part of the Project Board and project manager roles. It is for the project manager to identify, record, periodically review and propose planned actions to ameliorate the risks. The Project Board must notify the project manager of risks external to the project, make decisions as to which of the project manager's proposed risk avoidance options are to be pursued and balance the level of risk against the potential benefits of the project.

The management of risk is split into two processes:

- risk analysis, which is the identification of risks, the evaluation of their likely impact and the definition of actions which can be taken to minimise their effects;
- risk management, which addresses the monitoring and controlling of the actions identified to reduce the impact of risks, and thus improve the chances of the project achieving its objectives.

4.7. Quality Management

4.7.1. What is Quality Management?

The end result of the project must not only satisfy the requirements, but do so in a way that is sufficiently robust to provide continuous support for the needs of the organisation. Software systems are made up of many thousands, often millions, of instructions which operate on one set of data to produce another set of data. To ensure that these transformations are handled correctly on every occasion, and can detect and not perpetuate errors in the data they are operating on, each step of the process of turning requirements into a finished system must be quality checked.

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It is a function of project management to agree with the client organisation the level of quality which is appropriate to the system, and then to devise, implement and monitor controls to ensure that level is maintained.

4.7.2. Quality Management under PRINCE/2

The methodology uses the ISO 8402 standard definition of quality as "*the totality of features and characteristics of a product or service which bear on its ability to satisfy stated and implied needs*". For projects this means those features of the project's end products or services which make them fit for purpose in satisfying the objectives of the project. Within a project environment, satisfying *implied needs* introduces a good deal of uncertainty, and is avoided by the analysis and specification of requirements in sufficient detail to remove that uncertainty.

Quality Management is the process of ensuring that all interim and final products and services built during the project enable the results to achieve the level of quality required. Quality management has four main components:

- a **Quality System**. This provides an organisation structure and the processes and procedures to implement quality management. Where the customer and supplier have quality systems, one or the other or a pre-agreed blend of the two should be used;
- **Quality Assurance**. This is the vehicle for setting up the quality system, and, through a process of regular reviews and audits, ensures that it operates in a way which meets the quality needs of the organisation;
- **Quality Planning**. Identifying the quality objectives and requirements for a particular project is achieved by quality planning. This is a key part of the project initiation stage, and defines the quality approach for the whole project in the Project Initiation Document;
- **Quality Control**. This activity is concerned with examining products as they emerge to ensure that they meet their pre-determined requirements.

There are published standards for Quality Management Systems. These have evolved over the years, and currently the most universally accepted standard for design and development in the UK and Europe is BS EN ISO9001:1994. Many organisations are certified in their conformance with this standard by independent certification firms. It is accepted that use of PRINCE/2 can help an organisation to meet this standard.

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4.8. Configuration Management

4.8.1. What is Configuration Management?

Like any organisation, a project must manage its assets. In software development, these are not stock, plant and machinery, but the documents which specify the software, the software itself, and the management documentation (such as plans) which support communication within the project team and externally. The full set of these products is termed the *configuration* and thus their management is known as *configuration management.*

Configuration management is essential if there is ever to be more than one version of a product, and it is virtually unknown for any project not to have several versions of each product.

To take a small subset of a typical development project, a system design leads to a number of program specifications and a system test specification. If a problem is found during the system test, this may lead to revision of the systems specification, to a number of the dependent program specifications and to the programs. When the new version of the system is re-tested, it is essential that the right versions of the programs are run for that test. Without configuration management it is all too easy for old versions to be used, and of course the system test will fail again.

4.8.2. Configuration Management under PRINCE/2

The methodology identifies the four major functions required for configuration management:

- **identification** of all the components which go to make up the final product. This is essentially the inventory of the project's assets;
- **control** of the products. It would be impractical to place a product in development under configuration management, because the development is a process of constant build and change. There must however be the ability to state that, at a certain point, the product is complete, otherwise it cannot be used in later work which depends on it. Thus a completed product becomes a controlled product. If changes are later needed to it, a formal authorisation process is required to make the changes, and to identify all 'down stream' products which may be affected;
- **status accounting** provides a history of the evolution of each product and makes that evolution clearly visible. This enables the process to be tracked, and offers an audit trail of how and why changes were made;
- **verification**, to enable checking that a set of related products is consistent in terms of their versions.

Configuration management is closely associated with *change control*, the topic set out in the next Section.

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4.9. Change Control

4.9.1. Why Control Changes?

For all but the simplest projects, change is inevitable. The time span of large IS development projects ranges from a minimum of eighteen months to many years. During that time much may change in the customer's organisation. New business areas develop, old ones cease to be viable, competitors launch new products and regulatory or legislative changes occur.

However, change to specification or scope can ruin any project if it is allowed to happen without proper control. The impact of any potential change may be additional time or cost through new work or rework. In each case the impact needs to be weighed against the perceived benefits, and the decision to proceed or not made by the customer's management. Where changes are approved, the corresponding increase or decrease in the project's budget and time scale must also be authorised.

4.9.2. PRINCE/2 and Change Control

PRINCE/2 demands that each change considered be put forward as a change request. The relevant parties then assess the impact on the project, and provide estimates of the impact on time and cost which would be incurred if the change is authorised.

These estimates are then reviewed, by the Project Board or by a body (the *change authority*) set up by the board. If the impact is beyond the remit of the Project Board, approval must be sought from higher management. If a change request is approved, then a *change control notice* is authorised. This states precisely what is to be changed and the corresponding increase or decrease in time and cost budgets.

Where changes have a serious impact, it may well be necessary to replan the remainder of the project to accommodate them, almost certainly leading to development of an exception plan.

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5. ASSESSING PATHWAY'S MANAGEMENT OF THE PROJECT

5.1. Introduction

In Chapter 3 above we set out the reasons why projects must be managed, and followed this in Chapter 4 with a brief outline of one well accepted project management methodology; the one which Pathway proposed to use. In this Chapter we describe the way in which we have performed our assessment of Pathway's performance in this area, the assessment itself being set out in succeeding Chapters.

As set out in Chapter 1, our review is limited in scope to the systems development project. It does not cover the broader provision of the services which form the overall Card Payment Programme. To provide a firm foundation for the review and its findings, we have found it necessary to:

- clarify the limitations to our review imposed by lack of access to Pathway people and documents;
- define the differences between management of the overall Card Payment Programme and management of the development project;
- establish the degree to which Pathway was responsible for developing the necessary software;
- substantiate the view that Pathway was responsible for managing the project.

The following sections describe these factors in more detail, and are followed by a description of our approach to the assessment.

5.2. Limitations of Our Review

Pathway's own records are not currently available to us, and we have not had the opportunity of discussions with its staff. This restricts our work to those elements of project management which are clearly documented on the Authorities side of the contractual boundary, or where the effects of failures by Pathway are clearly visible to the Authorities .

5.3. Programme Management versus Project Management

There is a clear distinction between Programme Management and Project Management. The programme incorporates **all** the activities required to manage the business change expected to provide the benefits the Authorities were seeking. The project, as we have defined it, is restricted to the development of the computer systems on which the programme depends, and good project plans are a key input to the programme plans.

5.3.1. Programme Plans

Developing the plans for the programme was the responsibility of the PDA until April 1998, thereafter this role was transferred to the Horizon Programme team. To develop these plans, inputs were taken from the sponsors (POCL, DSS (including the Benefits Agency, the BA's CAPS programme, and the Social Services Agency for Northern Ireland)) and

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from Pathway. A series of programme plans, called Master Plans were produced. Two versions of these plans have contractual significance in that they define contractual milestone dates:

- version 1.0, approved at the PDA Board meeting of 13 August 1996, which reflected the original milestones set out in schedule B07 of the Authorities agreement;
- version 3.0, which was approved at the PDA Board meeting of 20 March 1997 and incorporated the revised milestone dates which emerged from the replanning done in February 1997.

Since April 1998 the programme plans have been produced by the Horizon programme team.

5.3.2. Project Plans

We believe (see 5.4 below) that Pathway was responsible for managing the project. Because provision of the new systems was critical to the programme, software delivery dates were in turn critical elements of the programme plan.

5.4. Pathway's Responsibility for Development

This topic was briefly discussed in section 1.1 of this report. We believe that Pathway's responsibility for the development of systems and interfaces is unequivocally supported by the clauses and schedule references from the related agreements set out at Appendix A.

While Pathway was free to select the development approach of its choice, it remains bound by Clause 702.2 of each of the related agreements. This states that *"the CONTRACTOR shall discharge its obligations under the* [AUTHORITIES'/DSS/POCL] *Agreement with all reasonable skill, care and diligence including but not limited to good industry practice and (without limiting the generality of this Clause) in accordance with the best of its own established internal procedures;"*

This clause, calling for the use of good practice, applies not only to the technical development of the system (see our report *"Pathway Systems Development Project - Systems Development Approach"*, [Ref. A.41.06]), but also to the management of the development project.

5.5. Pathway's Responsibility for Project Management

The Card Payment Programme was procured under the Government's Private Finance Initiative (PFI). An essential aspect of such procurements is the transfer of risk from the purchaser to the supplier. In essence the purchaser contracts for a set of services. These are paid for by the purchaser as a series of payments for services provided over the life of the contract. It is for the supplier to build the necessary infrastructure to provide the services (for example a bridge or computer system) at its own risk, and then recoup the cost, and make a profit, by charging according to some pre-determined schedule (by toll for a bridge, by transaction charges for a computer system for example).

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As the supplier is taking the risks, it is reasonable for the supplier to have complete control of the infrastructure building phase without interference from the purchaser. After all, it is for the supplier to develop a solution which meets the specified requirements in a way which best enables that supplier to meet time and cost constraints, and, hopefully, to make a profit from subsequent charges. If the services are delivered late, or do not meet the purchaser requirements, then the supplier will not achieve the expected revenue streams on time, or possibly at all.

There are however dangers to both parties in this reliance on the supplier, because:

- failure to apply good practice leads to delay in the introduction of the service;
- poor specification, development and/or testing of the software will lead to frequent errors, and increase the cost of maintenance. While the cost may be borne by the supplier, errors, and any slowness in clearing those errors, will impact the purchaser's customers with consequent monetary or reputation costs;
- it may prove difficult or impossible to persuade an alternative supplier to bid for the services as the end of the contract period, leaving the customer with no supplier or subject to predatory pricing by the incumbent.

For these reasons it is normal for the purchaser to insist on the application of good practice to all the activities which go into building the services. As cited in the previous Section, Clause 702.2 of the related agreements requires Pathway to use good industry practice in discharging its contractual obligations. The use of formal project management is recognised as good practice throughout the computer industry, and indeed in most project based activities. For this reason we interpret Clause 702.2 as requiring that Pathway manage the project in accordance with good industry practice.

Pathway, in its document *"Pathway Response to OJEC Notice 94/S 165-58937/EN"* submitted on 8 June 1995, (the Pathway Proposal) undertook to use the PRINCE project management methodology. The precise reference is Pathway Proposal, Annex 2, Section 2.2.5 paragraph 3. We understand that this proposal is included within the agreements by virtue of clause 706 (Statements and Representations), which states that "*The CONTRACTOR warrants and represents that all statements and representations made to the AUTHORITIES in connection with tendering for and entering into the AUTHORITIES' Agreement are, to the best of its knowledge, information and belief, true and accurate at the time of making such statements and representations and that, from the date of execution hereof, it will advise the AUTHORITIES of any fact, matter or circumstance of which it may become aware which would render any such statement or representation to be false or misleading.*"

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Pathway accepted the need to apply good practice, and stated positively that it would use the PRINCE methodology, which is generally accepted within the software development industry as being good practice. In our view, Pathway's acceptance of the need for good practice and adoption of PRINCE as its project management methodology reflects a clear understanding that Pathway held full responsibility for the management of the development process. At no stage has Pathway advised the Authorities to the contrary, or of any intention to use any alternative approach.

We therefore view the management of the development project as being Pathway's responsibility.

5.6. Our Approach

We have taken the PRINCE/2 methodology as the basis for our comparison. It is the successor to PRINCE, the methodology Pathway proposed to use. In our view the only significant difference between PRINCE and PRINCE/2 as they apply to the Card Payment Programme is that PRINCE/2 is less prescriptive. It allows the project more flexibility in the way the methodology is implemented, and has better provision for managing projects based on packages or modified packages.

As set out in Chapter 4, PRINCE/2 has eight major components. We have been able to review Pathway's performance against four of these (planning, controls, risk management and quality management), our findings on each factor being set out in the following Chapters.

We have not been able to review performance with respect to organisation or management review and decision points (project stages). This is because we do not have the access to Pathway's own records or to its staff which would be required to prepare a reasoned assessment of these two areas.

With respect to configuration management and change control, again we are not in a position to review Pathway's records, and cannot comment on its performance. However, from our experience of similar projects it seems to us that:

- without at least a reasonable configuration management process, Pathway would not have been able to achieve even the limited functionality already delivered. This view is reinforced by the amount of detail provided with each proposed release control document;
- the change control process appears to have been set up, and maintained, in accordance with good industry practice. While there may be disagreements as to the precise content, responsibility and charging for individual changes or proposed changes, the process itself seems well founded. We understand that the Authorities played a substantial part in defining and implementing this process.

Of the four components we are able to assess, planning is the critical factor. We have reviewed this up to award of contract and then at each point where project delays have occurred. We have reviewed controls, risk and quality management across the duration of the project.

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6. PATHWAY'S PROJECT PLANNING

6.1. Introduction

In this chapter we have addressed Pathway's approach to project planning. Our key conclusions are summarised in the next section, followed by an overview of the introduction of the concepts of phasing of software delivery and a brief history of the delays so far to the project.

There then follow a series of sections dealing with various replanning exercises, setting out for each what happened in the project, how we would have expected PRINCE/2 to have been applied to the replanning and our conclusions on Pathway's use of the methodology at that time.

6.2. Summary of Findings

From our review of the material available, we believe Pathway failed to follow good practice in its planning of the project. This was a critical failure both in the pre-award period, and from contract award until the replanning done in November 1997. From that point, Pathway's planning seems to have improved, but even so subsequent plans have not been achieved.

Our key conclusions are that Pathway:

- commenced its work on the Card Payment programme with inadequate plans, and possibly without any plans at all;
- was the major cause of the multiple project delays which occurred in the first 18 months after contract award, through its lack of planning;
- has caused the Authorities to incur additional direct costs through the need to test multiple releases of the system, rather than the one major delivery followed by a second delivery a few months later as originally agreed;
- has forced the Authorities to defer functionality to achieve a system which can be rolled out nationally. This is evidenced by the late introduction of New Release 2+, and by the creation of Release 3.0, a release who's scope has yet to be defined.

In our view, the most significant single cause of Pathway's failure to produce adequate plans was its failure to perform detailed analysis of the requirements. This topic is discussed more fully in *"Pathway's Approach to Systems Development" [Ref A.41.06]*. Without a detailed requirements specification, Pathway lacked firm knowledge of the work required to develop the system.

Without a detailed knowledge of **what** is to be done, it is **not possible** to develop detailed plans of how to do 'it'. Work break down (task) lists cannot be prepared, detailed estimates cannot be developed, and activities cannot be scheduled.

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6.3. Phasing of Delivery and Delays

6.3.1. Phasing of Software Delivery

The Related Agreements envisaged three software deliveries. These were:

- 'Initial Go Live' (IGL). This was to have very limited functionality for a few post offices;
- the full system. This was to provide all the functionality defined in the related agreements. Rollout was scheduled to start in July 1997;
- a further release of software three months later to introduce additional functionality.

Early in the course of the project, once Pathway realised it was not going to provide the software in time for rollout to commence in July 1997, the system was sub-divided into a series of releases. In the interests of keeping the programme moving forward, and to enable the Pathway system to align with the CAPS programme release schedule, the Authorities agreed to this 'phasing'. The first proposed phasing was not adhered to, and there has been regular redefinition of the contents of each release, with functionality moved forwards into later releases and, occasionally, back into earlier ones.

The phasing has forced the Authorities to spend more time on testing. While the overall effort needed to define all test cases may not have been greatly affected, the number of test executions has increased substantially. This has added to the costs and complexity of the programme.

6.3.2. Delays and Replanning

From the award of contract until the present time, the project has suffered continuous delays, and rollout of the full system has still not started. Delays have been formally announced by Pathway in:

- November/December 1996;
- May 1997;
- July 1997;
- November 1997;
- April 1998.

The most recent Pathway plan suggested a software delivery date which would have enabled the start of national rollout at the end of March 1999. Further delay means that this has had to be deferred. The current expected date for starting national roll out is August 1999, more than two years after July 1997 as envisaged under the related agreements.

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Not only have these delays occurred, but the software which may be rolled out in August 1999 does not possess all the functionality contracted for. This functionality will be added later, at a date yet to be confirmed but currently expected to be February 2000. If this last date is achieved the delay over original expectations will exceed 2½ years.

6.4. Up to Award of Contract

6.4.1. What Actually Happened

During the period between the notice requesting expressions of interest published in the Journal of the European Union on 30 August 1994 and the award of contract on 15 May 1996, Pathway:

- received the first draft of the Statement of Service Requirements (SSR) published in 19 December 1994;
- received the final SSR (Version 6.0) which was published on 13 April 1995;
- submitted *"Pathway Response to OJEC Notice 94/S 165-58937/EN"* on 8 June 1995, (the Pathway Proposal);
- took part in the Demonstrator Phase which ran from 28 August 1995 to 31 January 1996;
- received the Requirements Catalogue which was published on 6 February 1996;
- submitted its solutions to those requirements by 23 February 1996;
- submitted its tender (financial bid) for the contract on 21 March 1996;
- submitted a revised tender on 22 April 1996;

From the issue of the initial SSR at the end of 1994 to contract award in May 1996, Pathway had 16 months to assess and understand the requirements before committing to satisfying them. For the period from September 1995 to January 1996, the Demonstrator Phase offered five months with ready access to the business experts of the DSS and POCL to help all three bidders understand and confirm the requirements. With this experience, Pathway felt confident enough to submit its solutions to the requirements towards the end of February 1996.

In its proposal, Section 7.3.1.3, Pathway estimated the time required to develop the system as nine months. Pathway further stated that "*To achieve this* [the roll-out programme] *we will start the design and development of the systems during June 1995, using the demonstrator phase to confirm requirements and to demonstrate to BA/POCL a viable solution and our readiness to roll out.....*" (Section 7.3.1.5).

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The Pathway proposal provides no detail of the tasks involved or the estimated effort required to achieve the quoted dates. Neither in its tender of 21 March 1996 nor in the revised tender submitted on 22 April 1996 did Pathway set out detailed plans for the development and implementation of the services. None of these documents contains any detailed set of resource requirements.

The schedule adopted for the programme, and that to which Pathway agreed, was that set out in Schedule B7 to the Authorities Agreement. This schedule is reproduced in Table 6.1 below.

EVENT	DATE(S)
Date of execution of Related Agreements	May 1996
Development of Services pre-Operational Trial	March 1996 to August 1996
Operational Trial comprising the CONTRACTOR's Integration and Performance Testing, the AUTHORITIES' Acceptance Testing including the Live Trial of BES, CMS, PAS, APS, EPOSS, OBCS, POCL Infrastructure Services	September 1996 to June 1997
Limited Go-Live	From 23rd September 1996
Implementation planning for Roll-out	May 1996 to March 1997
Roll-out of POCL Infrastructure Services	July 1997 to December 1998
Roll-out of DSS Services	July 1997 to July 1999
Roll-out Review, Validation and Rectification Period (terminating on Roll Out Completion Date)	August 1999 to February 2000

Table 6.1 - Timetable at Contract Award

(Note: Where specific days of a month are not detailed in Table 6.1 above, we have assumed that start dates relate to the beginning of the month and end dates to the end of the month.)

From the schedule it can be seen that development work for the pre-Operational trial system was to start in March 1996 and be finished by August 1996. Allowing sufficient time for testing, this represents six months development effort.

Beyond this, schedule B7 called for completion of the operational trial by the end of June 1997. Backtracking from this date:

- the operational trial was to take three months, and thus needed to be started by the beginning of April 1997;
- contractor's testing was to take between four and six weeks, and thus would have had to start at the beginning of March (or by the middle of February if six weeks were required).

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On this basis, development work would have had to be completed, at the latest, by the end of February 1997. This would be:

- six months from the completion of pre-Operational trial software in August 1996, or:
- some 9½ months from the award of contract.

Even if extra elapsed time could have been found by overlapping some development and testing activities, it is hard to see how more than an absolute maximum of 10½ months development time could have been available.

At the start of the period available for development, no detailed specification of the requirements was at hand. It might have been possible to define requirements for one or two areas in sufficient depth to start system design for those elements in one or two months. Requirements definition for other areas would have needed more time but could perhaps have been conducted in parallel with the development of the first one or two areas. It is our view that at most nine months was available for the design, development, program and system testing of the overall system. This is the time originally proposed by Pathway, and we conclude that at the time of award of contract Pathway believed this to be sufficient.

6.4.2. What We Would Have Expected

To bid for a contract, particularly one of this magnitude and complexity, any supplier must recognise the need to analyse requirements to a level at which the costs involved can be estimated and an appropriate bid submitted.

Given that few bids are single tender, there is always the probability that any one bid will not be successful and the costs expended in producing it cannot be recovered. This is entirely normal in the software and services industry. The costs of unsuccessful bids should be recovered in those which do succeed. In our view, the fact that the Card Payment Programme was a PFI procurement makes no difference to the need for pre-bid requirements analysis and planning.

To ensure it was proposing a realistic project, and one on which it could reasonably expect to make a profit, we would have expected Pathway to produce a series of plans during the course of its bid for the Card Payment Programme. We believe Pathway had ample opportunity to do so through the extensive documentation of requirements provided by the Authorities, the opportunities for elucidating and clarifying requirements and the overall length of the procurement.

6.4.3. Conclusions

We conclude that no plan even approximating to a PRINCE/2 plan was prepared or used by Pathway prior to award of contract. We believe this view is supported by the lack of evidence of planning in the Pathway proposal.

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6.5. Award of Contract to First Replan

6.5.1. What Actually Happened

The first software delivery to support IGL was delivered on time. The IGL service commenced with one office on 23 September 1996, and four weeks later had been extended to a further nine offices. IGL offered a very restricted service for paying Child Benefit (ChB) by card. ChB is one of the least volatile DSS benefits,.

At the PDA board meeting of 21 November 1996, Pathway advised that it had done some replanning in order to maintain the live trial commencement date as 1 April 1997 and thus keep the start of national rollout to July 1997. Pathway introduced the concept of phasing delivery of the software as part of its revised plans.

The revised approach was considered by all parties, and, at the following PDA Board meeting (19 December 1996) the PDA presented reasons why it was felt the new Pathway phasing approach was unacceptable. Further consideration was given to the situation by all parties, and at the next PDA Board meeting (22 January 1997, agenda item 3., ref. 17), it was agreed that "*a solution based on a phased release of complete systems (application segmentation) was the best way forward*". This decision led to a replanning exercise the following month, known as the 'February 97 Replan', from which emerged a revised set of milestones.

6.5.2. What We Would Have Expected

We would have expected one of the earliest activities after award to be the development and agreement of a detailed requirements specification. At the same time we would have expected Pathway to use its increasing understanding of the detailed requirements to develop a project plan. As the detailed requirements were identified and agreed, so the corresponding work breakdown structures, estimates and resource implications could be built up.

We would have expected a detailed plan to the standard demanded by PRINCE/2 to be available within two to four weeks of completion of requirements analysis.

Given Pathway's responsibility for project management and the PFI environment of the project, there would have been no contractual obligation for Pathway to review or agree such a plan with the Authorities. However, the project plan is a critical element of the plan for the overall programme, which is clearly the Authorities' responsibility.

Pathway appear to have accepted the need for its project plan to fit into the master plan. This is supported in the notes of the PDA board meeting held on 13 August, under item 4.6, which states that "*Mr. Bennett (Managing Director of Pathway) confirmed that ICL Pathway were anxious to progress from drawing up plans to actually using them and were content therefore to sign off this version for that purpose. He did however want it placed on record that the plan*

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quoted dates which were a mixture of agreed baseline, planned targets and hoped for dates and this weakened the effectiveness and the process for review". The plan referred to is Master Plan Version 1.0.

6.5.3. Conclusions

By November 1996, barely six months into the development, Pathway became aware that it was going to have difficulty meeting the contracted dates. From this we conclude that Pathway started the development without a clear understanding of **what** was to be done, and therefore without a sound plan of **how** the work was to be carried out.

With hindsight it is clear the project could never have been accomplished by Pathway in the time scale originally proposed and accepted. Following PRINCE/2 principles in preparing a project plan would not have avoided some delay but would have revealed the problems much earlier, enabling them to be addressed more quickly and significantly reducing later delays.

6.6. The Replan of February 1997

6.6.1. What Actually Happened

Following Pathway's announcement that it could not meet the contracted dates, and the phasing of the project, the February 1997 replan started. One factor in the replan was that, from the preceding October, the CAPS programme had realised that it would not be able to meet its own plan. Two independent consultancy reviews of CAPS were initiated by BA, and their reports used as part of a wide-ranging replan of the programme. The result was some delay to the previous CAPS planned dates. These revised dates were incorporated into the Card Payment Programme replan of February 1997.

A revised programme plan was endorsed by the PDA Board meeting on 20 March 1997 as Master Plan Version 3.0. Pathway had substantial input to the dates in this plan, as did CAPS. The revised milestones from that plan were incorporated into the related agreements on a 'no fault' basis. Master Plan Version 3.0 recognised a series of software delivery dates for different releases, as set out in table 6.2 below.

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Release	For	Date Planned
1.b	Restricted live use (OBCS only)	28 April 1997
1.c	Restricted live use (1.b + BPS for ChB)	30 June 1997
1.d	To link to CAPS 2.2	1.c + 3 weeks
1.e	Live Trial (1.c + EPOSS + APS)	8 September 1997
1.0	Full use in national roll-out.	21 November 1997
2.0	National Use (Further functionality)	26 January1998
3.0	National use (")	April 1998
4.0	National use (")	October 1998

Table 6.2 - Release Dates from February 1997 Replan

When the February 1997 replan was agreed on 20 March 1997, there were essentially four major software releases planned. These were:

- Release 1.0, comprising sub-releases 1.b, 1.c and 1.e. Release 1.0 was to provide sufficient facilities to enable the programme to commence its national rollout on 21 November 1997. This would provide the OBCS, BPS, EPOSS and APS services with some restrictions in functionality, and with limited security;
- Release 2.0, to comprise a single software release, that is with no sub-releases, was to provide virtually all outstanding system functionality with a higher level of security;
- Releases 3.0 and 4.0 are not fully defined in the documents available to us, but from scrutiny of the release content descriptions of Release 1.0 and 2.0 it appears reasonable to suppose that Release 3.0 would complete all functionality and security features, and 4.0 would provide additional POCL functions as required and be the "*second release of the Software approximately three (3) months after the July 1997 implementation. This will enable the CONTRACTOR and the AUTHORITIES to introduce additional functionality at the counter and in the supporting systems which is identified after the Functional Specification has been approved by the AUTHORITIES*" envisaged in Schedule B07 to Authorities agreement.

It is worth comparing the situation at the February 1997 replan with that envisaged 10 month earlier at award of contract. Table 6.3 below compares anticipated software delivery dates (rather than start of rollout dates) for the two plans.

Original		Replanned		Delay
Release	Date	Release	Date	(Months)
IGL	23/9/96	Completed	On Time	None
1.0	Feb. 1997	3.0	Apr. 1998	14
2.0	May 1997	4.0	Oct 1998	17

Table 6.3 - Comparative Software Delivery Dates

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Release 1.b (which provided the Order Book Control System) was achieved almost on time. All subsequent releases were delayed, and as at April 1999 only Release 1.c is in operational use.

6.6.2. What We Would Have Expected

Once Pathway had decided on a phased release of the system, we would have expected it to have prepared detailed plans for the development and testing of each release. Such plans would have been necessary to determine:

- the work involved in developing the components of each phase, and therefore the phase contents;
- delivery dates for the software in each phase;
- any additional work occasioned by revising a software component from one phase to another;
- the resources required to work on each phase;
- what degree of overlap was possible in developing and testing the phases. Overlap would minimise the overall duration of the project, but would need to be balanced against the risks of reworking earlier development as new functions were added at later releases. A clear knowledge of the dependencies between tasks is required to make this judgement.

The software development plan would be one of the major inputs to the revised programme master plan, the accuracy of which would depend to a very high degree on the accurate prediction of software delivery dates. Because of the strong links between the two, we would have expected Pathway to ask for assistance from the Authorities in preparing the development project plan, both to improve its accuracy and to obtain the Authorities' support for it.

6.6.3. Conclusions

We conclude that Pathway again failed to develop realistic project plans during the February 1997 replan. We believe this view is supported by the following factors:

- the three slippages of Release 1.c (June to August, then August to October and finally to November). Taking the original time from the February replan date (20 March) to the then planned date of 30 June is 14½ weeks. The time actually taken after replan was 32½ weeks, an overrun of 125% on a 14½ week schedule;
- the very short notice given of each slippage. A well constructed project plan, properly monitored, would have given much more timely warning of the true impact of delays to early tasks on later, dependent, activities.

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It was at the point of the February 1997 replan that Pathway identified the need to deliver the software as a series of releases. In our opinion this demonstrates that, prior to this point, Pathway lacked a clear understanding of the size of the task it had undertaken. Planning carried out professionally much earlier in the procurement / development cycle would have made this obvious, perhaps in time to address the issues.

6.7. The Replan of July 1997

6.7.1. What Actually Happened

Release 1.c, due on 30 June 1997, was delayed by Pathway, citing problems with the Riposte software element. This delay was formally announced at the PDA Board meeting on 8 May 1997, just seven weeks after the previous board meeting had agreed the new plan, and less than eight weeks before software delivery was due. Pathway wished for a six week delay to 1.c, which would have moved the 30 June date to 11 August. At the PDA board meeting of 4 June 1997, it was recognised that Pathway could not meet its June date for 1.c, and 18 August was accepted for planning purposes for rollout to 200 post offices. At the same time it was recognised that Release 1.e would also be late, and it was deferred to 5 January 1998.

At the PDA Board meeting of 15 July 1997 Pathway presented a revised plan which it had drawn up following an internal review. This moved 1.c still further back, to 13 October 1997. At the meeting it is recorded that "*Mr. Crahan reported that it had appeared that everything had been moving forward toward achieving Congo 4 (Release 1.c) by the 18 August until PDA received information from MOR* [Model Office Rehearsal], *Integration Testing and Security Testing which identified real problems. On 3 July ICL Pathway informed the PDA that, following an internal programme review, they had concluded that they would not be able to meet the 18 August go-live date and proposed 13 October as the revised date for Congo 4. Since that time the PDA had been working with ICL Pathway to assess the detail. To date the PDA had not been given visibility of the low level detail supporting the high level plan for 13 October date, but it was hoped that this would be made available at a meeting currently taking place. It was essential that PDA were apprised of the detailed evidence supporting ICL Pathway proposals before any analysis of the achievability could be done and a plan built for Congo 4 to bring with confidence to the Board*". [Ref. BA/POCL Programme Delivery Authority Board, Minutes of the Meeting 15 July 1997, Item 3.1].

As part of the internal review mentioned above, Pathway had drawn up a presentation entitled *"ICL Pathway Programme Review July 1997"*. This showed very high level plans for the original and then newly proposed delivery plans for 1.c. It also proposed a schedule of future releases and outlined the contents of those future releases. The proposed schedule is shown in table 6.4 below.

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Release	Purpose	Date
CONGO 4 [Pathway 1.c]	Link to CAPS 2.1	13/10/97
CONGO 4.1 [Pathway 1.c]	Link to CAPS 2.2	03/11/97
CONGO 4.2 [Pathway1c+]	Link to CAPS Multi ACC	Jan. 1998
NILE 1.0 [Pathway 1c++]	Link to CAPS 3.0	Feb. 1998
NILE 2.0 [Pathway 'New' 2.0]	Link to CAPS 3.0	Mar. 1998
NILE 3.0 [Pathway 'New' 3.0]	Link to CAPS 4.0	Jul. 1998

Table 6.4 - Future Releases as proposed by Pathway (July 1997)

(Note: 'CAPS Multi ACC' refers to the CAPS systems running at multiple Area Computer Centres.)

The proposal effectively replaced 1.e with New Release 2.0 (NR2), and deferred the delivery of the Automated Payments 'SMART' service, Electronic Funds Transfer at the Point of Sale (EFTPOS) and other items originally scheduled for Release 2.0 (not NR2) into Release 3.0. Releases CONGO 4 Minus and CONGO 5 Minus were also dropped. It is not absolutely clear what these last two releases were, but it seems likely they were interim releases originally designed to link Pathway 1.e to different versions of CAPS.

At the next meeting of the PDA Board (21 August 1997), it was accepted (Item 2.1.4.6) that "*Pathway's plans for Release 2 were potentially deliverable but tight. Prime options and fallback options were being discussed. The problems were EVP* [Extended Verification Procedures] *and security. POCL also had problems with testing especially Electronic Point of Sale System (EPOSS). Pathway reported that their testing strategy was under review and agreed to pay particular attention to EPOSS*".

At the PDA Board meeting on 23 September, the anticipated release date for 1.c moved back yet again, this time to 3 November 1997, following problems in testing the software. This date was achieved.

6.7.2. What We Would Have Expected

By the time this replan was undertaken, Pathway had proposed, and the Authorities accepted, that development of the system would be in phases. The application of PRINCE/2 principles suggests Pathway should have used the time since the previous replan (February 1997) to develop more detailed plans for the development and testing of Releases 1.e onwards.

Given that this replan was announcing further delays, Pathway would have been wise to share its detailed level planning with the Authorities to validate its conclusions and to gain the Authorities understanding of Pathway's difficulties. This was not done in a formal sense, although we understand there was at least one planning meeting with the PDA staff. Detailed plans however require considerable time to understand and verify, and more than a single meeting would have been needed.

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6.7.3. Conclusions

There is some evidence in Pathway's decision to abandon 1.e, and to defer some functionality from NR2 to Release 3, that it was beginning to recognise:

- the complexity of the problem and the overall development effort which was going to be required;
- that too many releases would stretch Pathway's development and testing resources.

However, the subsequent slippage against all the dates forecast in July 1997 indicates quite clearly that Pathway's planning was inadequate. Without access to Pathway documents it is a matter of conjecture, but we believe that at this stage Pathway still did not have detailed plans for development. Had such plans been available, it seems unlikely that the July 1997 schedule would have presented, only for it to be radically revised four months later.

6.8. Delay and Replan - November 1997

6.8.1. What Actually Happened

The PDA Board meeting of 5 November 1997 returned to the issues of planning. A report was given by Mike Coombs, who had been appointed by Pathway as its Programme Director in July 1997. In relation to Release 2.0 he stated that "*there would be no work on forecast dates until the baseline had been signed off. Indicative dates had been given to assist with the PDA's planning, giving a window of 24 August 1998 to 9 November 1998, with 14 September 1998 being the indicative date. No account had been taken of a CAPS' window*". [Item 3.3, bullet point 3 of the minutes of the meeting refers].

We have sympathy with the approach of not planning until it is known what has to be planned, that is, once the 'baseline' definition of required functionality is agreed. In our view this marks the start of Pathway's attempt to bring some degree of professionalism to its management of the project. However, in this case it must be remembered that Pathway:

- was first advised of the requirements some 2½ years earlier, when they received the SSR on 13 April 1995;
- had been engaged on the development of the system for 1½ years since the award of contract;
- had just announced a 'best case' delay of 6 months to Release 2 (March 1998 to September 1998) a mere 2 months after its previous date had been accepted as *"potentially deliverable but tight" [PDA Board 21 August 1997]*;
- was still offering less functionality than had originally been promised in the software delivery expected in February 1997.

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At the same meeting (5 November 1997), Mr. Coombs was also able to report that "*since the last Board meeting, a series of structured reviews had taken place with the PDA on the plan for Release 2. Weekly review meetings were taking place on the plan-for-plan, issues management and key activity reviews. Formal checkpoint meetings had taken place on 13 and 31 October 1997*". [Item 3.3, bullet point 1 of the minutes of the meeting refers]. We see this as a most welcome sign that Pathway was beginning to involve the PDA in its planning.

Following the above meeting, and continuing into early December, a series of joint Pathway / PDA 'workshops' were held. On 25 November Pathway made a presentation entitled *"Pathway New Release 2 Replan Review"* to a number of PDA staff. On the third slide of this presentation Pathway state that its internal plan date for the start of live trial of Release 2 was 14 September 1998. Pathway also stated that "*Sensitivity analysis shows 5th October 1998 as 80%ile - therefore this date is offered for planning purposes*". We understand that no explanation was given of the process used in performing this sensitivity analysis nor any detail of the plan or model on which it was performed.

The presentation also introduced the concept of a 'New Release 2+' (NR2+). [Slide: "Release Strategy"] This was apparently to cover those items previously expected within Release 2 which would not now be provided until later. It also maintained references to Releases 3 and 4, and added a new Release 5. No dates were attributed to Releases NR2+, 3, 4 or 5.

At the next PDA Board meeting (11 December 1997), it was stated that 5 October 1998 would be accepted as the planning assumption for delivery of Release 2 software to enable the commencement of live trial in January 1999. [Ref. 3.1].

The PDA Board met for the last time on 26 March 1998. At that meeting it was agreed that the planned date for NR2+ should be July 1999. From 1 April 1998, the PDA ceased to exist and its functions devolved to the BA and to POCL. Much of the information reviewed in the remainder of this Chapter is derived from the minutes of Horizon checkpoint meetings from 2 June 1998 onwards. This forum essentially replaced the PDA Board meetings.

6.8.2. What We Would Have Expected

This replan was announcing still further delays. However, in this case we believe that Pathway had more detailed plans than those presented to the Authorities on 25 November. Our view is based on the higher quality of what was presented and the revised release strategy, both of which indicate more careful and professional planning.

Again we would have expected Pathway to review its detailed plans with the Authorities to gain their validation and acceptance. We understand that this was not done.

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6.8.3. Conclusions

In our view it was not until July 1997 that Pathway started to understand the full scope of what it had undertaken. Even by November of that year it still had not understood the full implications of its contracted commitments. Pathway responded to the problems identified by strengthening its management and project team, although too late to keep Release 1.c on target.

While the *"Release 2 High Level Plan"* which formed part of Pathway's presentation of 25 November 1997 does show dependencies between activities, there is insufficient information in the plan to evidence that it is the summary of lower level, more detailed, plans.

From this we conclude Pathway's planning by November 1997 was still some way from a level which could be considered as good industry practice.

6.9. Delay and Replan - April 1998

6.9.1. What Actually Happened

By early April 1998 it had become clear that Pathway would not be able to deliver NR2 in time to start national rollout by October of that year. A new programme plan was prepared by the Horizon team, and resulted in the issue of the *"Horizon Programme Replan Summary"* by the Authorities in July 1998. This document states that *"The replan activity was initiated by the Sponsors in conjunction with Pathway in April 1998...."*. [Ref. Horizon Programme Replan Summary, Section 2., para. 2].

There was some debate between Pathway and the Authorities in drawing up this plan as to the amount of time required for testing. Pathway's position was that one logical day's testing (the testing for example of the events on a single business day) could be accomplished in a single actual day. Despite the BA's insistence that this was not achievable, Pathway insisted on a plan based on this level of time utilisation. The BA's view was proved correct when the testing overran.

This replan called for delivery of NR2 software by 3 August 1998, and which, following testing, could lead to the start of national rollout in July 1999. However, NR2 would not contain all the contracted functionality, in particular it would not have on-line enquiries, soft EVP or additional POCL services such as the Automated Payments Smart Card facilities. These were expected in NR2+, which was expected to be delivered for testing by 1 October 1999.

6.9.2. What We Would Have Expected

We would have expected Pathway to discuss with the Authorities very detailed plans for NR2 and NR2+, and fairly detailed plans for subsequent phases. These plans would have included details of the estimates of time required for development and testing activities, the

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resources required for each task, and the dependencies between them. All these factors should have been informed by Pathway's development experience on the project, so that estimates could be realistic and resource shortfalls clearly identified.

It would then be reasonable to expect the Authorities to comment on those plans, and, where there were disagreements, for example on testing estimates, to develop consensus or at least compromises. The result would have been a revised plan in which all parties could have had reasonable faith. It would also have provided a firm foundation for the Authorities' own programme planning work.

6.9.3. Conclusions

It is our view, confirmed in discussions with CAPS personnel, that Pathway tended to subordinate planning to commercial issues. Pathway tried to fit the timescales in its plans to dates of commercial significance. We believe this is the reason Pathway insisted that one logical day's testing could be achieved in one physical day.

Even by April 1998 Pathway did not seem to plan on the basis of realistic estimates of the work required to complete all the tasks necessary to deliver a release. While conscious that the commercial pressures were high, such an approach was based on hope, not reality, and did nothing to speed implementation of the system nor provide accurate dates on which the Authorities could plan their own activities.

Overall we conclude that from November 1997 onwards, Pathway's project planning had continued to improve. Although Pathway appeared to have the capability to plan properly, it continued to subordinate realistic plans to commercial considerations.

6.10. Current Position (April 1999)

6.10.1. What Actually Happened

Pathway submitted NR2 software for the start of the first testing run on 4 August 1998. There were effectively two sets of tests run in parallel, end to end (E2E) tests and model office rehearsals (MOR) in preparation for model office test (MOT). Both are to be completed to the Authorities satisfaction as a pre-requisite for live trial.

End to end testing is designed to prove that all the functions of the system work within the Pathway application, and successfully link to other POCL and BA systems. It was originally intended to be three cycles of testing, but has been extended to provide four cycles:

- E2E cycle 1, which completed on 22 September, having overrun by two weeks in a five week schedule;
- E2E cycle 2, which commenced on target on 19 October 1998. It initially ran behind schedule, but was completed on time by 20 November;

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- an additional cycle, known as pre-proving. This comprised two sets of tests aimed at demonstrating that certain errors had been cleared and to get ready for the final end to tend tests;
- E2E Final, the final set of end to end tests. Preparatory work for this cycle started on 10 February 1999 and the tests completed on 17 March.

Model office rehearsals and tests are intended to check how the Pathway system functions work in post offices, including those functions related to BA transactions. Four cycles are used:

- MOR1 is the first cycle of model office tests. This was started on 3 August 1998 and completed on 27 August 1998;
- MOR2, the second cycle, started on 14 September 1998. It appears to have been completed on time;
- MOR3 was due to start on 19 October 1998. Although set up activities commenced on time, a problem delayed the start of counters testing until 22 October. Testing was completed by 12 November;
- MOT started on time by 15 February, and completed, also on time by 14 March 1999.

Further testing, designated 'targeted testing' aimed at demonstrating that software incidents have been resolved started on 24 March, and was completed by the beginning of April 1999.

Authorities reviewed the results, and a Release Authorisation Board (RAB) meeting was held on 7 April to determine whether or not NR2 software should be approved for use in the live trial. The meeting was unable to agree whether this was possible. POCL and Pathway considered that sufficient testing had been performed, but the BA did not concur.

Once approval for NR2 software to go into live trial is given, some time will be needed for:

- Pathway to install the software, and bring the computer sites and ancillary equipment up to the necessary level of readiness;
- migration of those offices on Release 1.c to NR2.

Had the RAB meeting on 7 April 1999 authorised release, live trial could have started on 10 May 1999, with the commencement of national rollout scheduled for the middle of August 1999. On this timetable, rollout of the necessary equipment to post offices would start in mid-June. It is not yet clear what impact the RAB's decision not to authorise NR2 for live trial will have on the rollout schedule.

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This still leaves the NR2+ release to be dealt with. This will be a software only release, and is expected to be installed from the end of February 2000. As this release is expected to contain all the contracted functionality, it is equivalent to Release 1.0 as envisaged in the related agreements. Full functionality may thus commence rollout 2 years and 7 months later than expected at the outset, and 2 years later than expected at the February1997 replan.

6.10.2. What We Would Have Expected

Again, to conform with PRINCE/2 principles, we would have expected to see Pathway maintaining detailed plans for the completion of NR2, the design and development of NR2+ and at least medium level plans for Release 3.0.

We have not seen such plans, but review of the Horizon checkpoint meeting minutes clearly points to Pathway sharing high level plans for NR2 with Horizon. We do not believe Pathway could have done this successfully, nor have got the likely date of rollout to within one month of that forecast a year earlier, without having detailed plans.

6.10.3. Conclusions

It is clear from the discussions at, and reports submitted to, the Horizon checkpoint meetings, that from the middle of 1998 Pathway was becoming ever more realistic in its planning. Pathway are now sharing plans, albeit the high level ones, with Horizon, and indeed is helping to ensure that its project plans align with the Horizon programme plans.

We believe that, in relation to NR2, Pathway has moved a long way towards planning at a level which now represents good industry practice. We have not had the opportunity of reviewing its detailed plans.

We determine a sense within the Horizon programme that NR2 will be rolled out at least broadly in line with the dates given above. We would however caution that:

- there is as yet no detailed plan for the design and development of NR2+. For obvious commercial reasons we believe Pathway will concentrate on getting NR2 installed, and there is a risk that it may, albeit temporarily, lose sight of the importance of NR2+;
- the rollout programme itself is likely to yield technical difficulties. It would be quite in line with the experience of similar projects for there to be performance issues as the number of users increases. Such problems are usually amenable to technical solutions, but these can be costly and may significantly slow the rate of rollout at times;

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- once a substantial part of the rollout is complete, it would be extremely difficult, in terms of reputational risk, for the Authorities, and in particular for POCL, to stop, let alone reverse the process. For this reason, progress on NR2+ and Release 3.0 must be monitored very carefully.

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7. OTHER ASPECTS OF PATHWAY'S PROJECT MANAGEMENT

7.1. Introduction

In this Chapter we set out our views of Pathway's performance with respect to the remaining three factors of project management defined by PRINCE/2, namely project controls, risk management and quality management.

Managing these factors in an active, rather than re-active, manner depends on planning for them. We have shown in the preceding chapter that planning was lacking, particularly in the early, formative, days of the project. One result of this poor planning is that there is little material visible on the Authorities' side of the contractual boundary to enable a detailed assessment of Pathway's project controls or its risk or quality management.

However, there is sufficient material to form an opinion, which should be tested and verified were access to Pathway's own documentation and staff to become available.

7.2. Project Controls

7.2.1. Why Have Project Controls?

One of the key objectives of having project controls is to enable the progress of the project to be measured. By putting a sound project plan in place, these controls can be applied, and progress stated, in terms of deviations from that plan. In this way, progress reports are on a basis of common understanding.

With a proper plan, delays to tasks early in the schedule can be detected and evaluated to determine whether they will delay later tasks, and eventually delay the project, or whether the slippage can be corrected. Even if overall slippage proves unavoidable, there is early warning of the problems, and other parties may be able to adjust their plans to minimise the damage. Without proper plans, delay may only be recognised late. There will then be little opportunity to recover.

Figure 7.1 below illustrates a simple dependency network. Each box represents a task, and the lines between them represent the order in which they must be completed.

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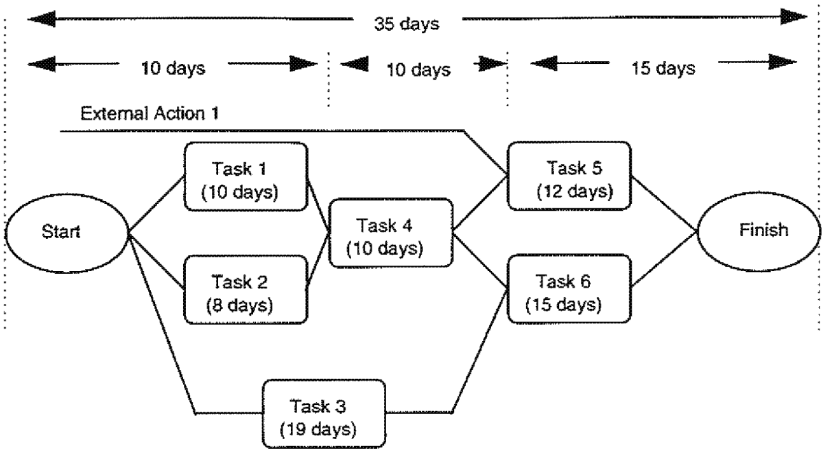

Figure 7.1 - Illustration of Task Dependencies

In figure 7.1 above:

- task 4 cannot start until tasks 1 and 2 have been completed;
- task 5 cannot start until task 4 has completed and external action 1 has been satisfied;
- task 6 cannot start until tasks 3 and 4 have been completed.

The elapsed time to complete all the tasks is expected to take 35 days (Task 1 + Task 4 + Task 6). This is the critical path through the network. Any delay to these tasks will automatically delay the 'Finish' point. Tasks 2, 3 and 5 all have some 'slack' time. Task 2 could be delayed by two days without affecting the finish, task 3 has one days slack and task 5 three days. It should be noted that 'external action 1' must be completed before task 5 can start. This could, for example, by the agreement of a specification.

If task 1 was delayed, say by two days, this would be picked up by the project control system, at worst as soon as the delay occurred, but perhaps earlier. There would still remain 23 days (35 minus 12), and this might be sufficient to, for example, assign additional resources to task 6 so that it could finish two days earlier. Thus the network would complete on time. If the delay was not picked up until day 35, there is of course no time for remedial action.

External action 1 is required no later than day 23 (35 minus 12), and if this were not to happen, then completion of the network would be delayed by one day for every day the external action went uncompleted. This would be a key dependency for the project to manage, as, being external, the project would have less control over it.

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7.2.2. What Actually Happened

The project has been subject to continuous delays, as set out in Chapter 6. A number of these delays were announced by Pathway at very short notice, and this is in our view prime evidence that it was not controlling the project in accordance with good industry practice.

Pathway submitted a paper "*Selection of Examples of Problems Facing Pathway as set out in the Pathway Position Paper Dated 6 March 1998*". This undated paper, of 53 pages and marked "*Without Prejudice*" contains a large list of complaints by Pathway, many of which allege delays by the Authorities in supplying information which Pathway needed to continue development of the system. None of these allegations contain any statements of the form 'Pathway needs this information by [date] if the project is not to be delayed'. In our earlier reviews of the project [April 1998 and August 1998] we also found no evidence of such statements. In our view this points firmly to there being no project plan and no project control.

This lack of control we find quite perplexing. Where software suppliers undertake fixed price software development it is very much the norm for any delay by the customer, for example in supplying information, to be cited as a reason for delay and to support the recovery of increased costs. In the environment where a plan has been agreed between the parties, this is a reasonable, if often contentious, approach, particularly as it works both ways.

The software development for the Card Payment programme incorporates a fixed price software development contract, albeit one where the development is paid for out of future revenue. We would have expected Pathway to take a 'hard nosed' attitude toward any delay by the Authorities in meeting planned dates.

Planning by Pathway has improved since the end of 1997, and we would expect that project controls would improve in parallel. Our review of the minutes of the Horizon checkpoint meetings from April 1998 confirms that such improvement has indeed taken place.

7.2.3. Conclusion

We conclude from the short notice of delays provided by Pathway, and its inability to define firm dates by which actions by the Authorities are required to avoid delays, that for the first 18 months of the project Pathway:

- had no project controls in place;
- was driven by events as they unfolded, not by careful monitoring of the on-going project, and thus had no means of either making up lost time or of providing early warning of delays. Pathway was not in control of the project.

Such a situation does not provide the level of project control which good industry practice demands or which is offered by the PRINCE/2 methodology.

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7.3. Risk Management

It is a fundamental requirement of project management that the risks to the project are identified, assessed and measures to control them put in place. While we do not have access to any risk register which Pathway may maintain, it is clear that there were risks to the project from external sources, notably from the Authorities. There is no doubt that the drop down process and the Contracting Authority Responsibilities (CARs) represented risks to Pathway's system development project.

Pathway recognised this in its paper "*Selection of Examples of Problems Facing Pathway as set out in the Pathway Position Paper Dated 6 March 1998*", in which it cites the drop down period *[Item 7.]* and Contracting Authority Responsibilities *[Item 10.]*. In both cases the paper complains of increased costs and delays, and with respect to CARs, of disruption.

We have found no evidence in our reviews of the PDA Board meeting minutes, nor in the Core Negotiating Team (CNT) minutes for the period to April 1998 of any attempt by Pathway to add these two matters to a risk register. Yet from the award of contract these, together with Agreements to Agree (A2As), represented external activities which impinged to some extent on the development of the software. It should be noted that the majority of issues during drop down, the CARs and the A2As relate to the provision of the services under the contract. Only a relatively small minority have an impact on the development of the software.

We would have expected that, under a PRINCE/2 project approach, Pathway would have established a risk register, and shared this with the Authorities so that a common understanding of the size, impact and priority for resolution of the risks could be established. The risk register should have been the subject of regular review with the Authorities so that all parties could agree the responsibilities and actions necessary to reduce or eliminate those risks. We find no evidence that this was done at any appropriate level of reporting.

We conclude that Pathway failed to manage risk in accordance with good industry practice.

7.4. Quality Management

Even before the award of contract it is clear that Pathway was well aware of the need for quality management. Its proposal [Annex 2. Pathway Quality Policy] states at item 2.1 that:

"2.1 GOALS

Pathway's goal is to meet or exceed BA and POCL expectations throughout the life of the contract. This goal will be achieved by:

(a) Adopting the Strategic Quality Model (SQM) within Pathway for Total Quality Management, driven by customer needs.

(b) Establishing and implementing a Quality Management System and relevant processes, e.g. Subcontractor Performance Management, Service Level Management, auditing and performance analysis and improvement.

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(c) *Gaining ISO9001 or equivalent accreditation via Third Party assessment, and ensuring all sub-contractors meet this standard."*

Later in Annex 2, item 2.4 states that:

"2.4 QUALITY MANAGEMENT SYSTEM DOCUMENTATION

The Quality Management System will be supported by a comprehensive set of documentation describing appropriate processes and procedures, in accordance with the requirements of ISO9001. This will consist of:

(a) *Quality Manual, which will state Pathway's policy, define end-to-end processes and provide a documented set of managerial instructions.*

(b) *Control procedures, which will define detailed methods and controls used to assure Quality, for example design procedures and standards, subcontractor standards, change procedures, audit procedures.*

(c) *Work instruction which will define procedures for specific tasks, for example test specification, upkeep of documentation, meeting minutes."*

At award of contract, Clause 5 to Schedule A2 of the related agreements calls for:

"5 CONTRACTOR'S POLICIES AND STANDARDS

5.1 Quality Management System

5.1.1 The CONTRACTOR shall operate a quality management system which complies with BS EN ISO 9001:1994 for all its activities within the scope of the AUTHORITIES' Agreement.

5.1.2 The quality management system shall be applied to all aspects of the delivery of Services hereunder.

5.1.3 The quality management system shall be audited and certified by a BSI accredited auditor, who is independent of both the CONTRACTOR and of the AUTHORITIES:

(a) *in any event, at intervals of not longer than twelve (12) months, and*

(b) *in addition, within twenty (20) Working Days of any such request.*

5.1.4 The CONTRACTOR shall within one (1) month of each audit (i) provide the AUTHORITIES with copies of all reports produced by the auditor on the quality management system, and (ii) notify the AUTHORITIES of and carry out the CONTRACTOR's proposed follow up actions where required."

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Given this proposed and contracted commitment to quality management, we would have expected Pathway to use the four main components necessary for effective quality management:

- a quality system;
- quality assurance;
- quality planning;
- quality control.

The last of these, quality control, is the only aspect which we have had the opportunity to review in terms of the design documents passed by Pathway to the Authorities. The technical documents we have reviewed appear to have passed through quality control procedures. However, many of them required several reviews by the Authorities before they could be accepted, with many comments on each version. This suggests to us that quality control procedures concentrated on the form rather than the substance of the documents. We regard this as a weakness in quality control.

We have had no opportunity to review directly Pathway's quality management system. However, quality control comes from the planned application of a quality system which in itself is defined and maintained by quality assurance. We therefore believe that the weakness of quality control points firmly to inadequacy, and possibly non-existence, of some or all of these components.

We also understand from the Joint Contracts Team that in the event Pathway has not gained ISO9001 or equivalent accreditation, although it is not known whether or not it has attempted to do so. ISO9001 is not strictly required under the contract as clause 5.1.1 to schedule A2 states, *"The CONTRACTOR shall operate a quality management system which complies with BS EN ISO 9001:1994 for all its activities within the scope of the AUTHORITIES' Agreement"* (our underlining). However, if Pathway's quality management system truly does comply with ISO9001, then, we find it surprising that it has not been so accredited. If it does not, then Pathway is in breach of the requirements of clause 5.1.1.

We are also a little surprised that the Authorities have not availed themselves of their rights under clauses 5.1.3 and 5.1.4 above in relation to the software development project. At least two annual audits under 5.1.3 should have taken place already (May 1997 and May 1998) with another imminent.

Our conclusions are based primarily on the uneven quality of documents presented to the Authorities and the amount of time necessary to review and revise them before they are acceptable. We believe that Pathway has failed to apply quality management to the development at a level in accordance with good industry practice.

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APPENDIX A - DEVELOPMENT SERVICES

In determining that Pathway is responsible for developing the software required to support the Card Payment Programme and for managing the project to develop that software, we reviewed the contracts for the programme and the relevant schedules to those contracts.

There are three contracts involved, known as the Related Agreements. One is between Pathway and both DSS and POCL. The other two are agreements between Pathway and the DSS and between Pathway and POCL respectively. We have used the following acronyms to distinguish the agreements in this Appendix:

JNT: The 'Joint' Authorities Agreement

DSS: The Benefits Agency Agreement

POCL: The Post Office Counters Agreement

All: All three agreements

Relevant Clauses

201(DSS) Contractor to meet the requirements specified in Schedule A15 in accordance with solutions specified in Schedule A16 by performing the Basic DSS services referred to in clause 201.2:

DSS Development services in clause 402
Roll out services in clause 404
DSS Steady State services in clause 405
Management services in clause 602
DSS Contingency services in clause 409
Transfer services in clause 906

201(POCL) Contractor to meet the requirements specified in Schedule A15 in accordance with solutions specified in Schedule A16 by performing the Basic POCL services referred to in clause 201.2:

POCL Development services in clause 402
Roll out services in clause 404
POCL Steady State services in clause 405
Management services in clause 602
POCL Contingency services in clause 410
Transfer services in clause 906

401(JNT) Contractor to develop:

Service Architecture Design Document
All necessary interfaces to create the Service Architecture.

402(DSS) Contractor to develop:

Optional DSS Services (Schedule C1)
Card Management Service (Schedule E1)
Payment Authorisation Service (Schedule D1)
Service Architecture Design Document
DSS Contingency Services (Schedules D9 & E9)

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402(POCL)	Contractor to develop: Optional POCL Services (Schedules C1 & H1) Benefits Encashment Service (Schedule D1) Automated Payment Service (Schedule E1) EPOSS (Schedule F1) POCL Infrastructure Services (Schedule G1) Service Architecture Design Document POCL Contingency Services (Schedules D9,E9,F9,G11 & (optionally)H9)
601(All)	Authorities entitled to monitor Contractor performance per Schedule A4 procedures.
602(All)	Contract management performed per Schedule A4
602(DSS)	DSS Services to be managed per Schedules D5 & E5
602(POCL)	POCL Services to be managed per Schedules D5, E5, F5 & G7.
605(DSS)	DSS undertakes to provide all information, services, facilities and responses designated as DSS responsibilities in Schedules D3 & E3. DSS to use all reasonable endeavours to perform these to any agreed timetable per Schedule B9.
605(POCL)	POCL undertakes to provide all information, services, facilities and responses designated as POCL responsibilities in Schedules D3, E3, F3 & G5. POCL to use all reasonable endeavours to perform these to any agreed timetable per Schedule B9. If it cannot be resolved by the Group within 14 days, it shall be referred to Expert resolution or the English courts.
702(All)	Performance of Services. Pathway undertake to use appropriately skilled staff, and use good industry practice in the discharge of its obligations. Sub-clause 702.2 is of particular relevance to this report.
706 (All)	Statements and Representations.

Relevant schedules

A4(All)	Contract Management:
1	Objectives
(JNT)	To monitor and manage the relationship between the three parties and to authorise actions affecting the interests of both Authorities.
(DSS)	To monitor and manage the delivery of the DSS services and to authorise actions which improve those services.
(POCL)	To monitor and manage the delivery of the POCL services and to authorise actions which improve those services.
2	Organisation
(JNT)	A Contracts Steering Group to be established to co-ordinate the agreement.
(DSS)	A Contract Administration Group to be established to co-ordinate the agreement.

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(POCL)	A Contract Administration Group to be established to co-ordinate the agreement.
D3, E3 (DSS)	DSS Responsibilities Lists specific DSS responsibilities
D3, E3, F3, G5 (POCL)	POCL Responsibilities Lists specific POCL responsibilities

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APPENDIX B - DEFINITIONS OF TECHNICAL TERMS

This Appendix sets out a number of the technical terms used in this report, together with our definitions of those terms.

B.1 Requirement(s)

A business need which is to be provided, made possible or not prevented by the system. Requirements may be defined at significantly different levels of detail:

- **high level**, which encompasses a very broad business need. If for example the aim was to produce a new billing system for a telephone company, one high level requirement might be "the system must be able to accept regular and variable payments by direct debit";
- **detailed level**, which, building on the example above might state "the system must generate a customer advice setting out details of the payment to be directly debited to their account" AND "the system must be able to correctly account for direct debits returned unpaid by a Bank" AND "the system must notify the account manager and customer in the event of a direct debit being unpaid".

It is quite possible for requirements to be stated at levels between the high and the detailed. Such intermediate stages provide a better understanding of the complexity of the higher level requirements as they are analysed (see "Analysis"). This increased understanding can provide early insights into how the eventual system should be organised (perhaps as linked sub-systems rather that as a single system), or indeed whether the requirements can be met at all.

B.2 Specification

A specification is a document which contains sufficient information to enable an item to be built entirely from that specification without further explanation. For example, an engineering part specification might state "take a bar of 10mm diameter EN8M steel, face the end flat to a surface finish of ± 10microns, centre drill BS1, turn down to 8mm ± 0.05mm for a distance of 20mm ± .05mm and part off".

Such a specification would enable any reasonably experienced turner with access to the right tools, raw materials and measuring equipment to make the part with no reference to anyone else.

For IT systems, specifications are produced for the detailed requirements, for the system itself, for each program which makes up the system, and for the processes of testing the system and ensuring the system meets the users' requirements.

B.3 Analysis

The process of breaking down requirements at a particular level into more detailed requirements at a lower level, a very critical process in IT systems development.

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B.4 Design

In this document "Design" refers to the process of system or program design:

- **System Design** is the process of producing a specification for each of the major components which will comprise the full system. Using the example of a telephone billing system, there might well be sub-systems to cater for:
    - * the maintenance of information about customers, such as adding new customers changing names and addresses, altering bank details, deleting customers who decide not to use the service;
    - * generating bills from call information, despatching those bills, reconciling them with cheques or other payments received, handling direct debits;
    - * accounting for payments and receipts;
    - * providing analyses of calls and payment patterns or other information useful to the direction of the enterprise.
- **Program Design** results in a specification for each program in each system component. Such a specification details:
    - * the output data the program must produce;
    - * the input data it can use to produce the output;
    - * the processing rules which determine how the outputs are formulated from the inputs, for example "if the input billing marker is "direct debit" then generate a direct debit advice and direct debit record for the Bank, otherwise generate an invoice and a request for payment";
    - * various technical parameters such as what to do with errors, the programming language to be used and links to the operating system. (This is not an exhaustive list).

B.5 Quality

The quality of an IT system may be defined as its "fitness for purpose". A telephone billing system might be deemed to be fit for purpose if only, say, one bill in ever 10,000 was wrong (although overbilled customers might not agree!). An air traffic control system could not be deemed fit for purpose if it allowed one crash in every 10,000 landings. Although both systems require that they be built to a certain level of quality, that level, and the cost of achieving it, is very different.

A computer system is built from a series of specifications of increasing detail. From these specifications, software is developed, and then tested, first each program in isolation, then as groups of programs and finally as a complete system. If quality is built into each specification and program as it is developed, the end result will be a system fit for purpose, and testing becomes the final quality assurance operation.

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If the desired level of quality is not built into any system from the outset, the only way of determining if it is fit for purpose is to test every combination of data through every possible path through the system. Such a task is essentially impossible for any but the most trivial system.

B.6 Testing

Testing should really be a particular case of quality assurance, in that at each of the levels set out below assurance is sought that the system or component performs to its specification, a specification which has itself been quality checked. The levels are:

- **Acceptance Testing**, which is normally specified and conducted by the users of the system. Acceptance testing ensures that the system does what the users need it to do, and does so in a way which fits into their normal business processes;
- **System Testing**, is normally specified and conducted by the system's developers, although often in conjunction with user representatives. Its purpose is to ensure that system satisfies all the requirements set out in the requirements and systems specifications. This will include a series of technical, performance and resilience tests;
- **Integration Testing**, may be used as an intermediate step between system testing and program testing, where the complete system is made up of a number of inter-dependent sub-systems. Integration testing is used to ensure that each sub-system operates correctly on its own before testing its interfaces to other areas;
- **Program Testing**. Each program is tested to ensure it performs in accordance with its program specification. Such tests are usually specified by the author of the program design (preferably as part of that design process) and either conducted by the programmer who wrote the program with results checked independently or conducted independently.

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DOCUMENT CONTROL

Change History

Version	Date	Status	Purpose
1.1	11 Feb 1999	Draft	Reviewed by PML 22/2/99
1.2	15 Feb 1999	Draft	For review by PML on 26/2/99
1.3	9 Mar 1999	Draft	For review by PML on 9/3/99
1.4	9 Mar 1999	Draft	Report Development only
1.5	18 Mar 1999	Draft	For review by PML on 23/3/99
1.6	23 Mar 1999	Draft	Minor changes from review on 23/3/99
1.7	25 Mar 1999	Draft	Major restructuring of Chapter 6
1.8	31 Mar 1999	Draft	Changes from review on 31/3/99
1.9	8 Apr 1999	Provisional	Changes from review on 8/4/99
2.0	19 Apr 1999	Provisional	Further changes from review 8/4/99
2.1	28 Apr 1999	Provisional	Changes from review 26/4/99

Changes Forecast

The review scheduled for 28 April 1999 is expected to yield no more than changes to correct typographical and grammatical errors. The next version is expected to be submitted for client review.

Distribution

Project Mentors	Bird & Bird	Benefits Agency	POCL
ADD, JP, AJW	Hamish Sandison	---	---

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References

No.	Reference
1	Pathway Systems Development Project - Systems Development Approach [Ref. A.41.06]
2	Pathway Systems Development Project - Requirements Review [Ref. A.41.07]
3	Pathway Systems Development Project - Management Summary [Ref. A.41.08]
4	Contract between Pathway and the DSS and POCL, the 'Authorities Agreement'
5	Contract between Pathway and the DSS, the 'DSS Agreement'
6	Contract between Pathway and POCL, the 'POCL Agreement'
7	PRINCE/2 Manual - CCTA
8	PDA Master Plan Version 3.0
9	Horizon Master Plan Version 4.0 / Integrated Programme Plan
10	Horizon Programme Replan Summary
11	Pathway Response to OJEC Notice 94/S 165-58937/EN (The Pathway Proposal)
12	Statement of Service Requirements Final Version 6.0 of 13/4/95
13	Minutes of the PDA Board Meetings
14	Minutes of Horizon Checkpoint Meetings
15	ICL Pathway Programme Review July 1997
16	Pathway New Release 2 Replan Review
17	Selection of Examples of Problems Facing Pathway as set out in the Pathway Position Paper Dated 6 March 1998. An undated paper of 53 pages, marked 'Without Prejudice'
18	Minutes of the meetings of the Core Negotiating Team (CNT)

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REPORT
PATHWAY SYSTEMS DEVELOPMENT PROJECT
REQUIREMENTS REVIEW

Ref: **A.41.07 V1.5**
Status: **Provisional**
Prepared : **April 1998**

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SECTION **PAGE**

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1 INTRODUCTION

1.1 Context

This report is one of a set of related reports commissioned to support potential litigation and negotiations for settlement of that litigation with respect the to the Card Payment Programme. The structure of this set of related reports is illustrated in figure 1.1 below, which highlights the position of this report within that structure.

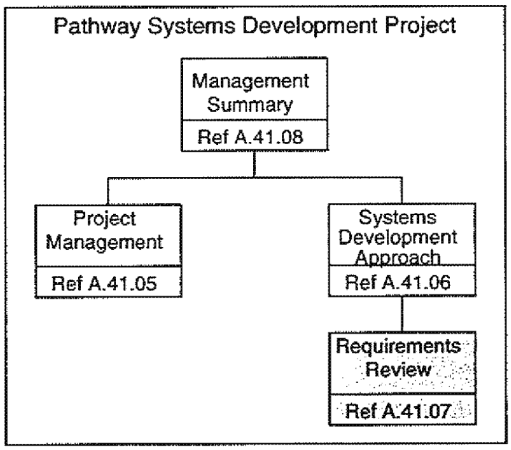

Figure 1.1 - Structure of Related Reports

Our report *"Project Management"* [Ref. A.41.05] sets out our assessment of Pathway's management of the project, while the *"Systems Development Approach"* report [Ref. A.41.06] describes our findings with respect to Pathway's development approach. This report - *"Requirements Review"* [Ref. A.41.07] - presents our analysis of certain areas of the Authorities requirements. The overall findings of our review are set out in *"Pathway Systems Development Project - Management Summary"* [Ref. A.41.08].

It should be noted that there are links between the management and technical factors, and ideally this report should be read in conjunction with its companion papers.

1.2 Scope of The Report

In our initial report [Ref. Expert Review of BA/POCL Payment Card Programme - Initial Report August 1998, Project Mentors.] we stated:

"It is our impression that ICL Pathway have been primarily responsible for the delays to the programme by seriously under estimating the effort and time needed to develop the services and, as a result, not allocating sufficient resources to complete their contracted obligations within the agreed timescale."

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As a common cause of such a failure is poor analysis of business requirements, we have performed a review of Pathway's approach to this analysis. We have examined the business requirements expressed at the time of contract signing and compared them against the current understanding of the Authorities' requirements.

This work was based on documents from both the Authorities and Pathway, together with very limited informal discussion with BA staff at Terminal House.

1.3 Purpose

This report has been commissioned to support potential litigation and negotiations for settlement of that litigation. It therefore aims to provide negotiators, who may not be wholly familiar with IT developments, with an assessment of Pathway's performance in this area.

Because people without a systems background may use the report, we have striven to provide a view that we trust will be readily comprehensible. We have as far as possible avoided the use of IT "jargon". However, the concepts described in this report need to be understood if the scale and impact of failures in following good systems development practice are to be recognised.

1.4 Constraints

Currently (April 1999) we do not have access to the great majority of Pathway documents or to their staff. In consequence, our findings are based on relevant items in the Authorities possession.

1.5 Structure of Report

The report is structured into the following chapters:

- Chapter 1, this chapter, presents background information;
- Chapter 2 describes our approach to the review;
- Chapter 3 presents the results of our analysis;
- Chapter 4 presents a number of observations that result from our analysis.

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2 REVIEW APPROACH

2.1 Introduction

We were surprised to discover that no detailed analysis of the requirements, an essential process for successful IT development, appears to have been performed. To allow us to compare current requirements with the original requirements, the review team therefore initially selected the BPS (Benefits Payment System) element of the system as a sample, and assembled a draft requirements analysis. This allowed us to consider Pathway's claims regarding DSS requirements. We then performed an equivalent exercise on POCL's EPOSS (Electronic Point of Sale System) requirements.

Requirements analysis is the vital first step in turning high level business requirements into systems specifications from which software can successfully be developed. We had anticipated therefore that our comparison would be between a requirements analysis post-contract and the current version of that analysis. We could find no evidence in either the Horizon library list or DSS libraries of such an analysis. Discussions with DSS & POCL staff at Terminal House and DSS staff at Norcross and Longbenton failed to identify any unrecorded but relevant documents.

A direct comparison between the requirements expressed in the catalogue (text) and those **implied** in Pathway's design documents (mostly text) was not feasible because of different structure, inconsistent naming, etc. To enable us to compare like with like, we analysed the requirements in the catalogue using Logical Data Modelling and Data Flow Diagrams and then compared the functions and data expressed in Pathway's design documents with the analysis. This approach is illustrated in figure 2.1 below.

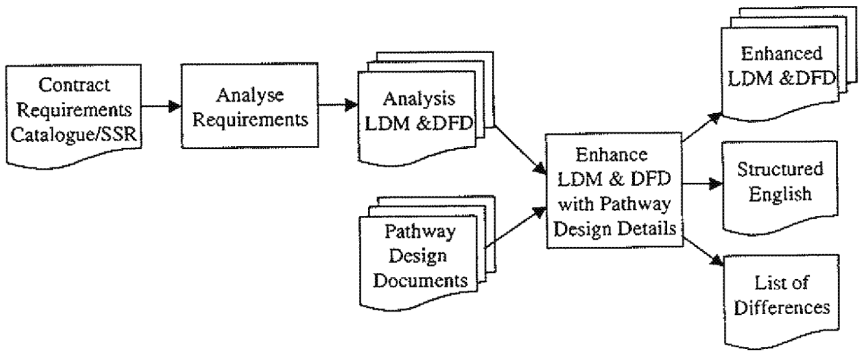

Figure 2.1 - Comparison Approach

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2.2 Analyse Requirements

This work was based initially on the final version of the Authorities' Statement of Service Requirements ("SSR"). This document was issued to potential suppliers in April 1996. While not a contractual document, in our view this is a well produced and thorough document which would have given any potential supplier the opportunity to gain a thorough understanding of the system through analysis and questioning.

We then examined the Contract Requirements Catalogue to ensure we had complete coverage of the Authorities requirements. The output from this process was a draft Logical Data Model and Data Flow Diagrams

2.3 Enhance LDM & DFD with Pathway Design Details

The documents reviewed at this stage were principally those produced by Pathway, although we also considered a number of CAPS and POCL definition documents. The principal aim of the activity may be expressed as - "Is there any entity, attribute or functionality described in the Pathway documents that is not present in the Authorities requirements"?

We derived the implied business requirements from the Pathway design documents, discarding design detail not relevant to the Authorities business requirements. We then matched them to the Authorities requirements in their analysed form. Because of inconsistencies in naming of entities and attributes in different documents it was necessary to make some assumptions about equivalence.

We also produced definitions of the principal DSS functions. These are written using indentations to show a logical structure, often described as structured English.

The results of this second stage of analysis were:

- an enhanced LDM and DFD;
- structured English descriptions of those DSS business rules where Pathway had raised the issue of 'optimisation';
- a list of the differences between the Authorities' requirements and their requirements as implied by the Pathway design documentation.

2.4 Stages of Analysis

Our initial analysis focused upon the DSS' requirements. This enabled us to consider the following Pathway claims of 'optimisation'. The results of this evaluation were recorded in our Position Paper on requirements optimisation [Ref. Position Paper - Requirements Optimisation, Project Mentors document A.42.07]

The second stage of analysis focused upon EPOSS. This area of functionality was chosen for the following reasons:

- EPOSS is the foundation of POCL's business requirement;

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- The BES component of the DSS' requirements runs as an application within the EPOSS environment. It was therefore important to understand how the two interacted;
- EPOSS is controlled, to a large extent, by POCL's Reference Data. Reference Data has been an issue raised by Pathway. We wished to understand the issue better.

2.5 Time Scale

Our high level analysis of the BPS requirements took four weeks effort from a single consultant, spread over a period of two months.

Requirements analysis is an iterative task, which makes it difficult to be precise about the amount of time spent on each individual activity. However, an approximate break down would be:

- Initial (SSR) data model - 2 days
- Current data model - a further 3 days
- DFDs - 1 week
- Structured English - 2 weeks

The analysis of the EPOSS requirements took some six weeks effort. This reflected the more extensive requirements of POCL..

We would like to stress that we have not produced a fully detailed analysis of requirements for BPS or EPOSS. We have taken the analysis only to that level which enabled us to determine whether Pathway's claims of optimisation and lack of clarity were valid. It is our view that a detailed requirements analysis could have been produced in no more than nine months, and probably less, given:

- the right number of appropriately skilled staff;
- correct and speedy resolution of queries by the Authorities.

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3 REQUIREMENTS ANALYSIS

3.1 Introduction

This chapter presents the results of the analysis in the form of Data Flow Diagrams (DFDs) and Logical Data Models (LDMs). The details of the analysis have been recorded using the System Architect CASE (Computer Aided Software Engineering) tool and the diagrams are an output from the tool. Greater detail has been recorded than is presented here. In particular, the names of all the attributes of the business objects have been entered in the CASE tool.

3.2 Payment Card System Outline

The following text and diagram is reproduced from the SSR:

Figure 3.1 below "*shows the component services (in boxes) within the procurement service boundary (the large oval) that are to be provided by the Service Provider. Outside the procurement service boundary are the services (in boxes) and users (in small ovals) with which and whom the Service Provider will interface. The dotted box around Value Added Processing (VAP) is to indicate that the Transaction Management Service (TMS) is part of VAP*".

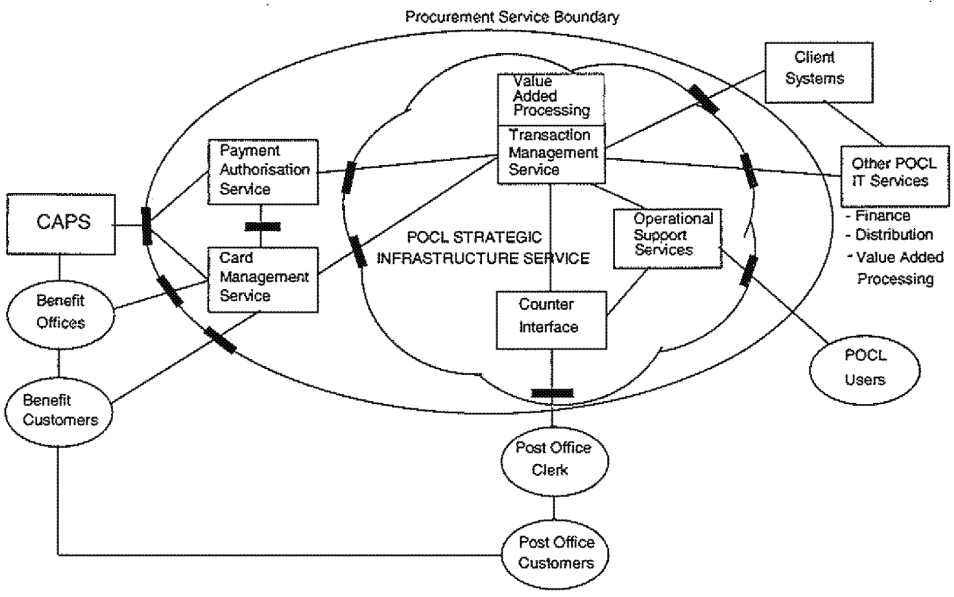

Figure 3.1 - The Service Architecture

We have used the Procurement Service Boundary to define the scope of our analysis. The analysis is divided into the following components:

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- BPS - The end-to-end service defined by the Authorities and represented in the above diagram by Payment Authorisation Service (PAS), Card Management Service (CMS), and that part of Counter Interface that is the Benefit Encashment service (BES). The separation of BPS into these components is a constraint upon the technical solution, however it is not a business requirement of the Authorities. For our analysis of business requirements, the separation has been excluded;
- EPOSS - The major part of the Counter Interface.

3.3 Diagram Notation

The analysis is represented by a series of diagrams. The notation used is as follows.

3.3.1 Data Flow Diagrams

A Data Flow Diagram (DFD) illustrates the way in which data (or information) is passed around the system, and how it is transformed and stored within the system. A diagram shows the following:

- **External Entities** - Rectangles at the edge of the diagram. The people, organisations and other computer systems that act as sources of data to, or recipients of data from, the system - for example Counter Clerks, Help Desk staff and the CAPS system;
- **Processes** - Soft cornered rectangles. These represent business activities carried out upon and triggered by data. They should not be confused with computer programs. A process may sometimes equate directly with a program, but even then will be defined in user terms rather than in computer jargon. In other words, it should reflect the business activity it supports;
- **Data Stores** - Narrow rectangles marked with the letter 'D'. These are, as their name suggests, stores of data within the system. They may be computerised data stores or manual data stores (filing cabinets etc.);
- **Data Flows** - These are arrows which represent the flows of data to, from and within the system.

3.3.2 Logical Data Model Diagrams

A Logical Data Model (LDM) uses the following notation:

- **Boxes** - represent the main objects of interest to the business, for example Outlets and Counter Clerks. These are also termed business entity types;
- **Lines** - represent the nature of relationships between entity types. For example an Outlet may have one or more Counter Clerks working at the Outlet and a Counter Clerk must work at one and only one Outlet.

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3.4 BPS

3.4.1 BPS Functionality

In outline, BPS provides facilities for:

- Maintaining customer details;
- Providing and validating encashment tokens (payment cards and temporary tokens);
- Entering customer payments;
- Validating and recording encashment of payments;
- Recording details of customer sessions at Post Offices;
- Maintaining details of Post Offices and other standing data.

3.4.2 BPS Diagrams

The following diagrams provide an overview of the analysis:

1. BPS High Level Data Flow Diagram: The principle functions of the BPS requirement. These functions are performed by a combination of PAS, CMS and BES.
2. BPS Logical Data Model: The business objects of interest to the Benefits Agency.

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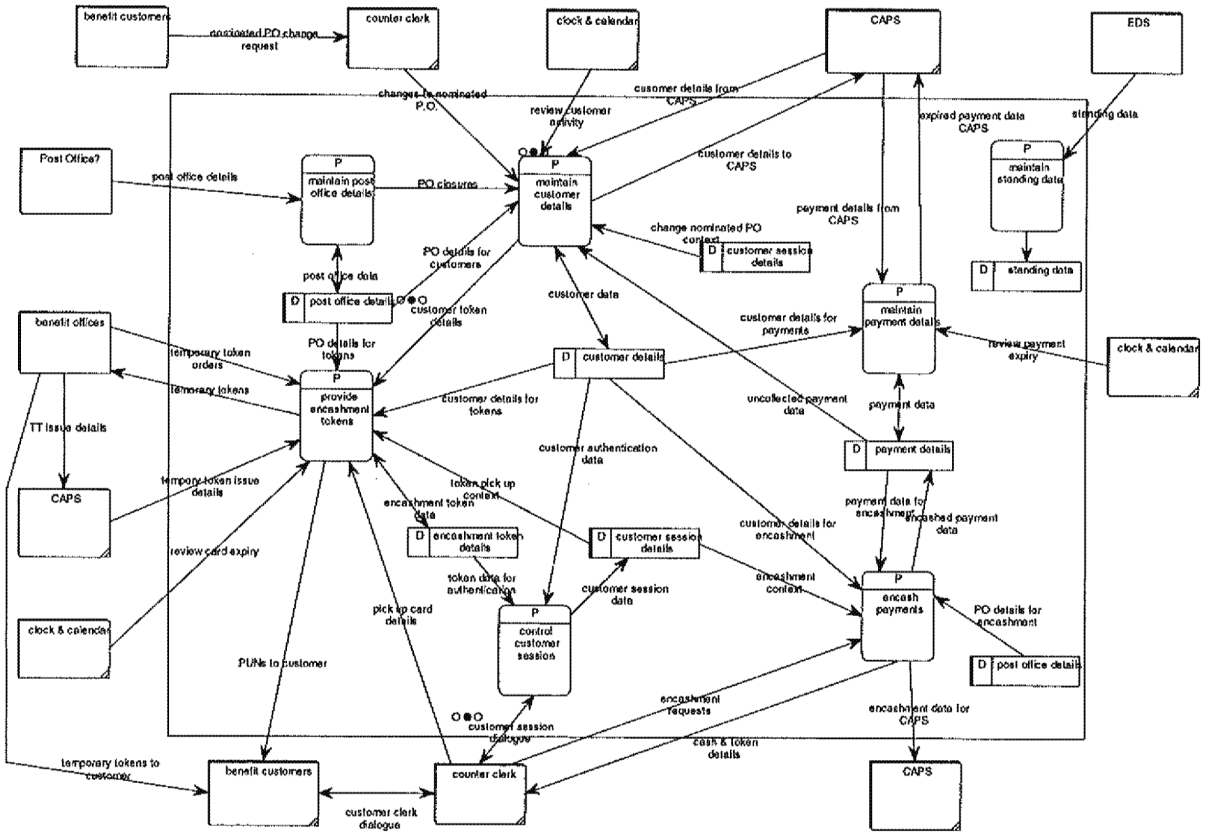

Figure 3.2 - BPS Data Flow Diagram

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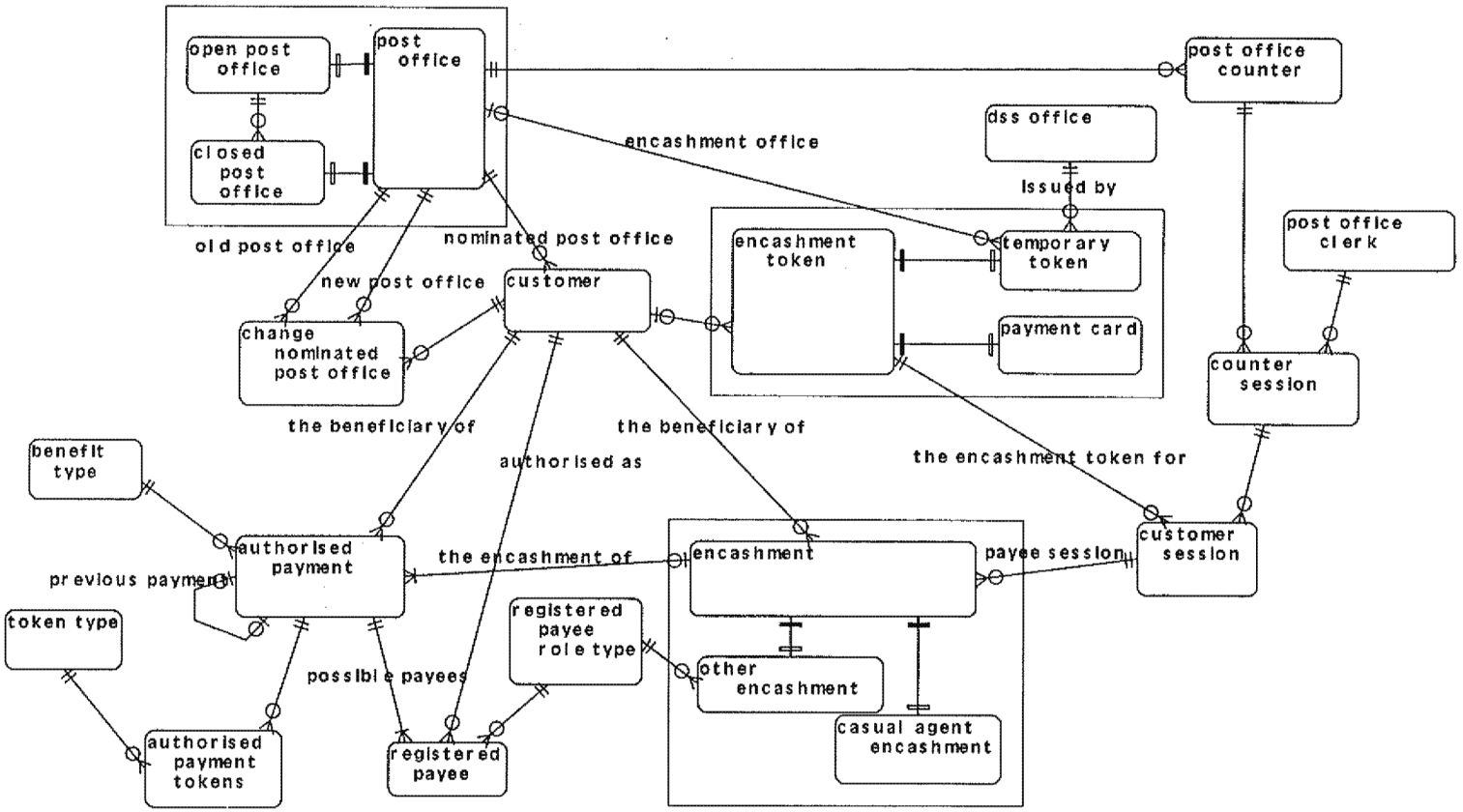

Figure 3.3 - BPS Logical Data Model

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3.5 EPOSS

3.5.1 EPOSS Functionality

In outline, EPOSS:

- provides post office counter clerks with support facilities in the sale of Post Office/ Client products and services (BES and APS being examples of services);
- provides stock ordering and management facilities
- provides administrative and reporting facilities
- is the accounting system for an outlet

POCL provides Pathway with details of all POCL's outlets, products and services via a file interface. Pathway then ensures these details are distributed to all Post Offices.

Pathway, in turn, provides POCL and POCL's clients with details of all EPOSS transactions performed at Post Offices on their behalf.

3.5.2 EPOSS Diagrams

The diagrams reproduced below are:

- EPOSS High Level Data Flow Diagram: The principle functions of EPOSS including the maintenance of POCL Reference Data.
- EPOSS Logical Data Model Subset - Stock Items: The business objects that describe the products and services sold and provided at an Outlet.
- EPOSS Logical Data Model Subset - Scales: The data relevant to calculating charges for objects weighed on counter scales.
- EPOSS Logical Data Model Subset - Stock Details: Information gathered during stock balancing activities.
- EPOSS Logical Data Model Subset - Sessions: Information gathered about counter sessions and the types of session.
- EPOSS Logical Data Model Subset - Transactions: Information gathered about transactions performed within sessions.

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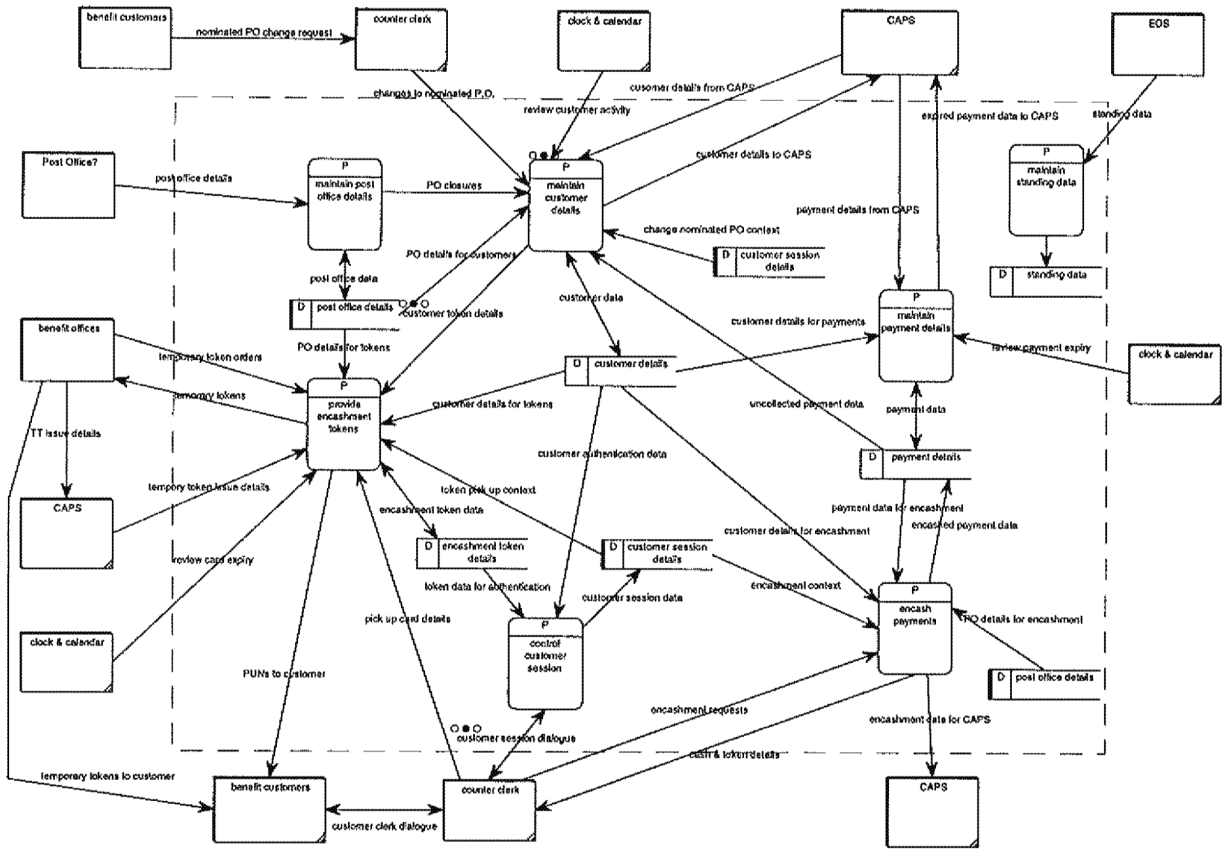

Figure 3.4 - EPOSS Data Flow Diagram

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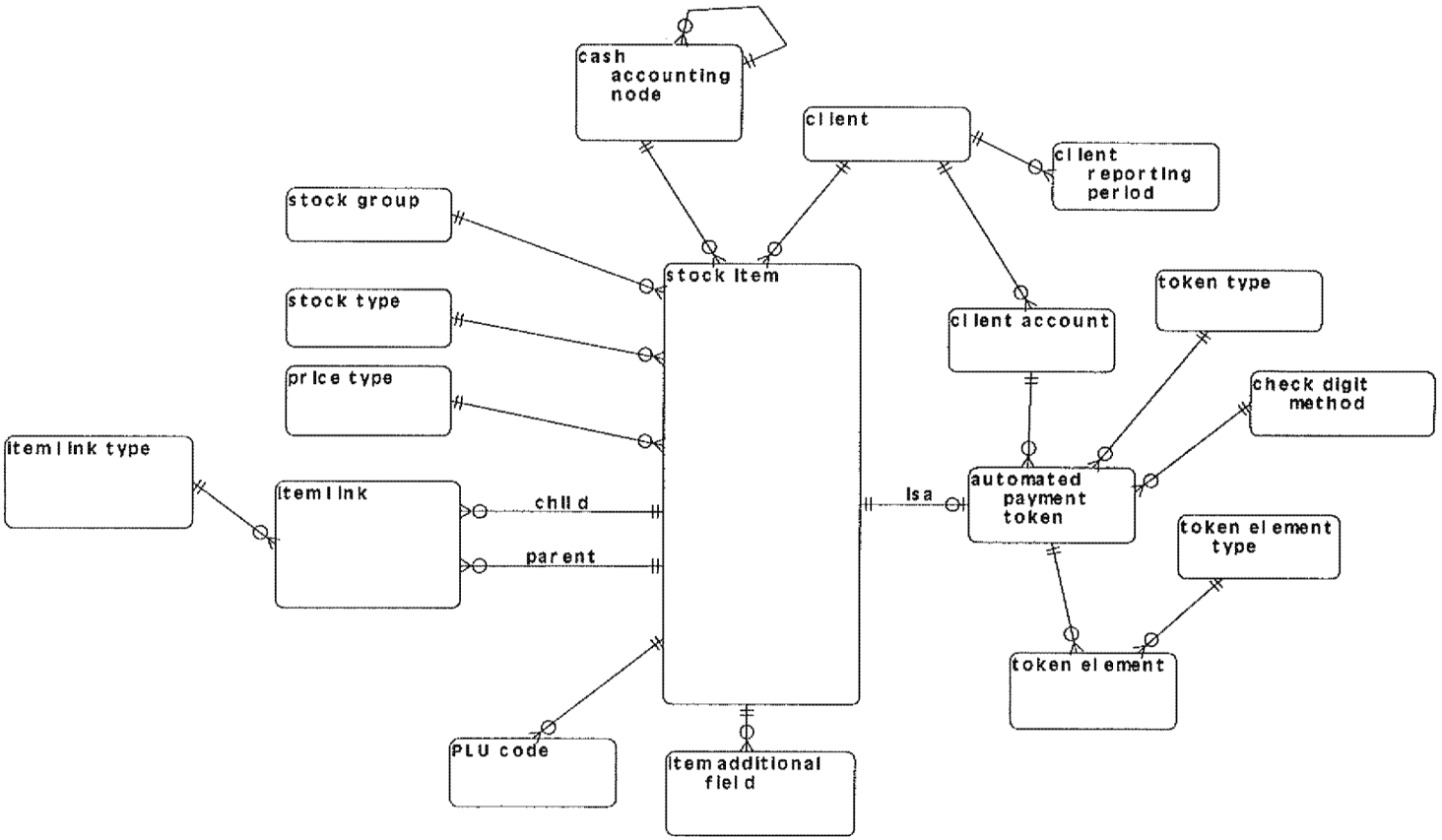

Figure 3.5 - EPOSS Logical Data Model - Stock Items

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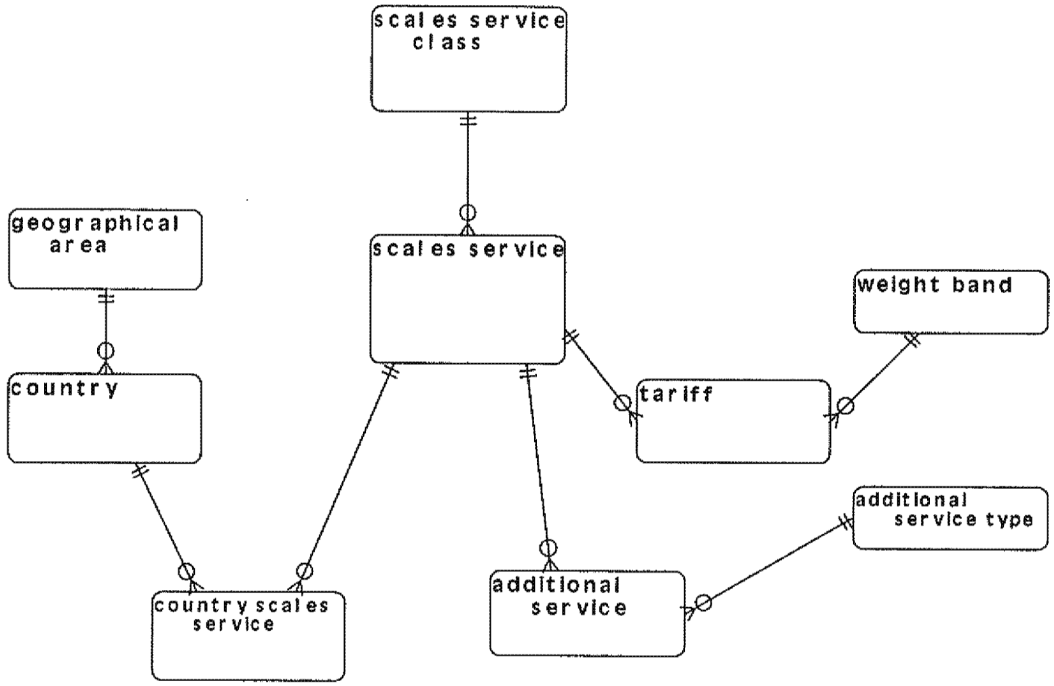

Figure 3.6 - EPOSS Logical Data Model - Scales

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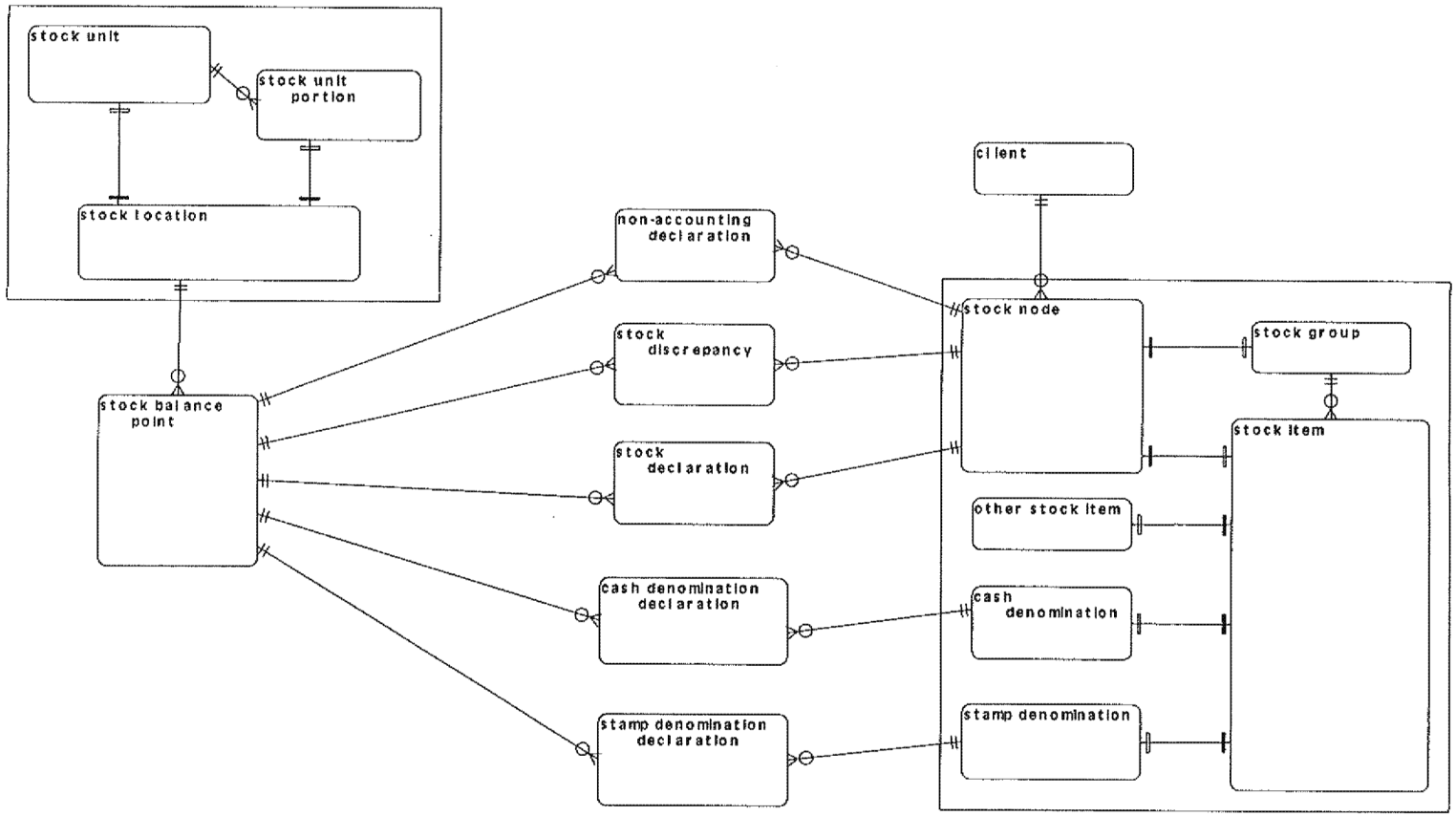

Figure 3.7 - EPOSS Logical Data Model - Stock Details

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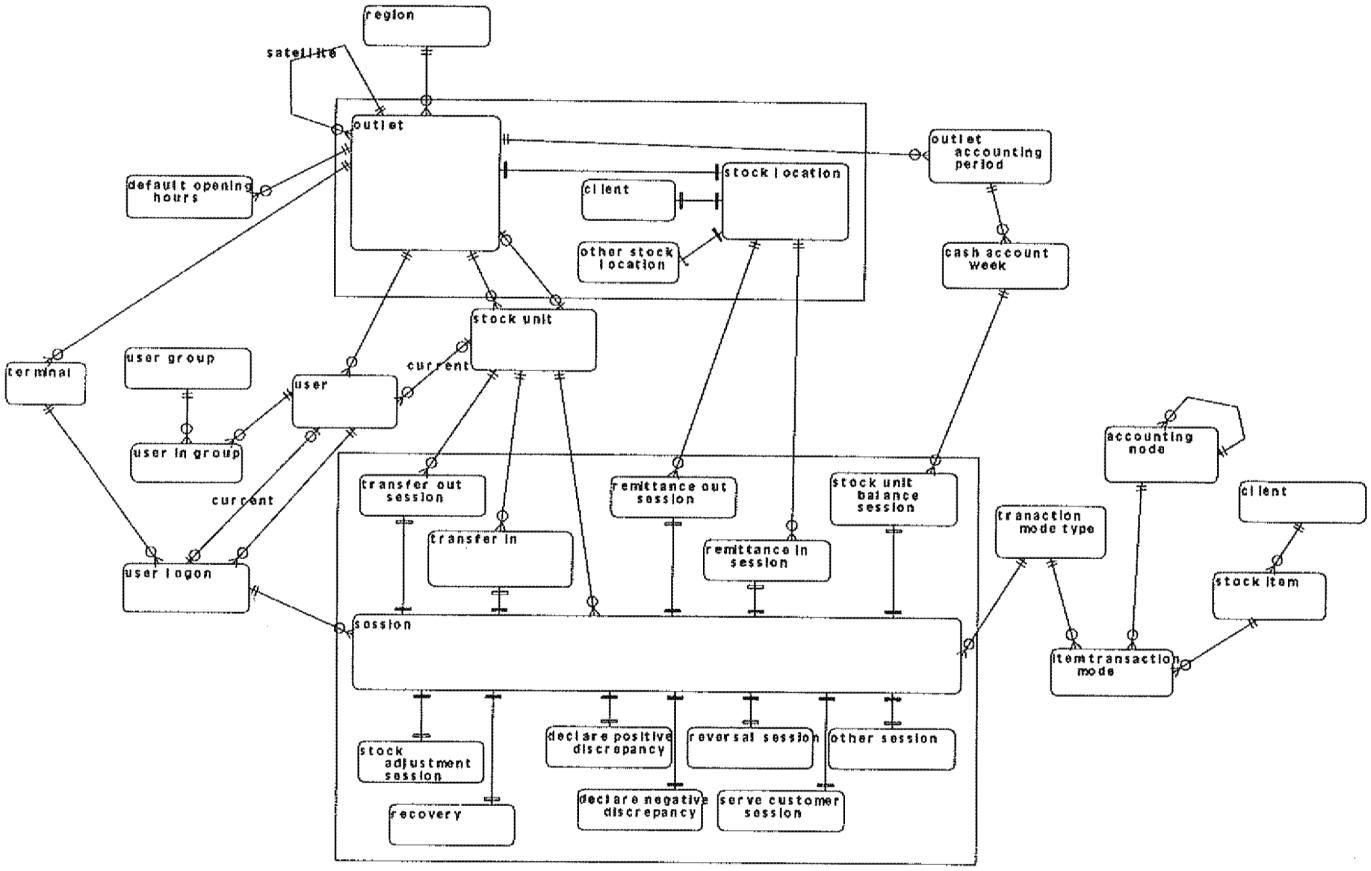

Figure 3.8 - EPOSS Logical Data Model - Sessions

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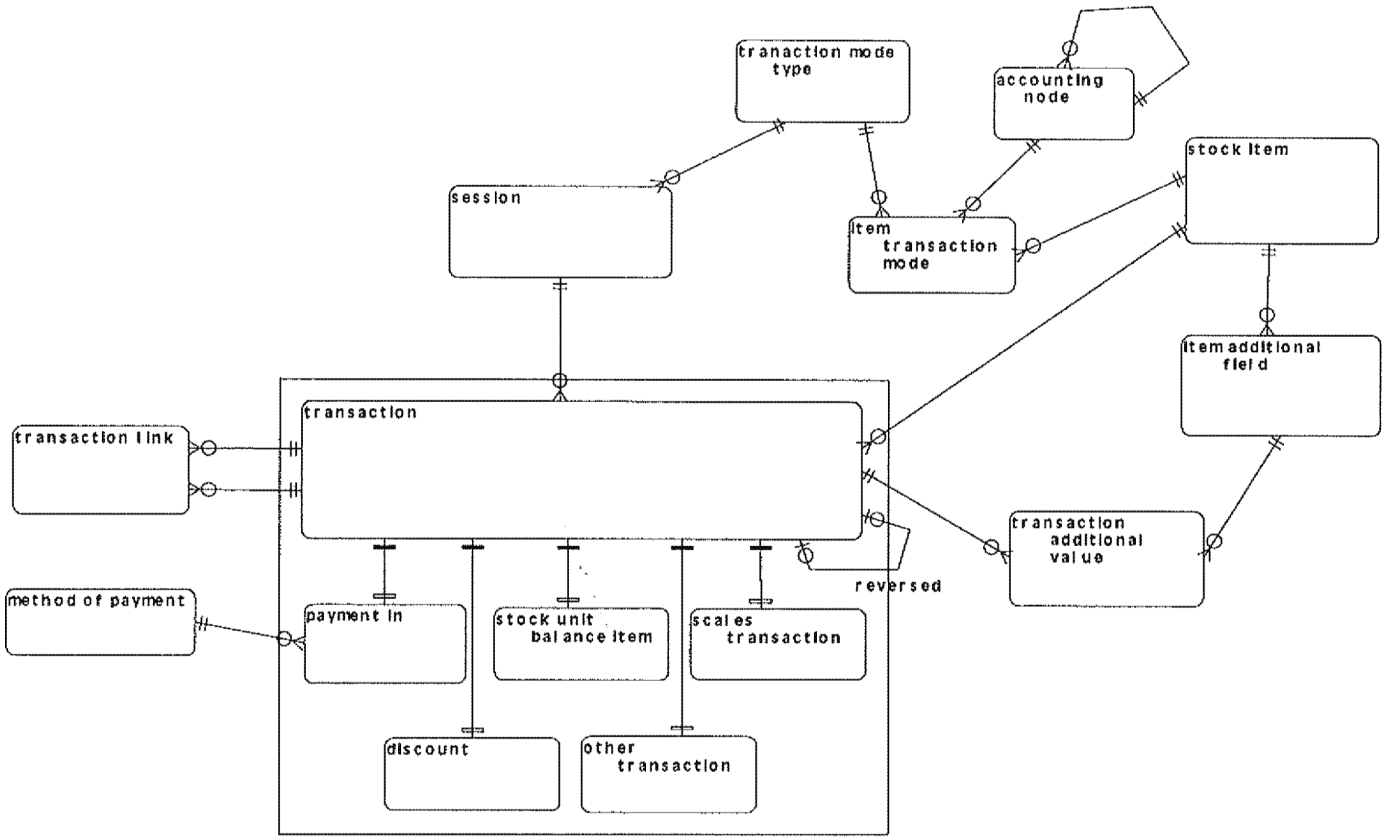

Figure 3.9 - EPOSS Logical Data Model - Transactions

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4 OBSERVATIONS

4.1 General

4.1.1 Changes in Requirements

We found no changes of substance in requirements between those expressed in the contract and those 'implied' by Pathway design documentation. However, as would be expected:

- there is more detail in the Logical Data Model derived from physical design documentation, but noticeably only in terms of their being additional attributes to each of the data entities. There are no new data entities;
- the functionality is described in more detail in detailed design documents than it is in the contract. However, we found no additional primary functions in the design documentation.

It is of interest to note that, without specifically attempting to, the process also identified one or two BPS exception cases in terms of business process. While Pathway and / or the BA may have identified these cases, they are not documented in the programme's technical library.

4.1.2 Inconsistent Naming

There are a significant number of instances of business objects relevant to both BPS and EPOSS but known by different names in documents describing the requirements and/or design. There is thus scope for misunderstanding which may become apparent during testing.

During the analysis we have made assumptions on correspondence of names. The following table presents these assumptions:

BPS	EPOSS
Post Office	Outlet
Post Office Counter	Terminal
Counter Session	User Logon
Customer Session	Serve Customer Session (sub-type of Session)
Encashment	sub-type of Transaction

These assumptions have not been verified with any Authorities staff.

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4.2 EPOSS

4.2.1 Requirements Match

The POCL business requirements are more extensive and complex than those of the Benefits Agency. However, the EPOSS requirements in the contract and the SSR are not as well structured or detailed as those for BPS. Nevertheless, the requirements catalogue does identify all the elements that are represented in the derived model.

4.2.2 Stock Portion

When shared stock units are balanced, each counter clerk using the stock unit has to enter appropriate stock declarations relating to that part of the stock unit that they manage. They are required to enter a 'portion id' to uniquely identify their part. The portion id is not registered with the EPOSS system. It is, in effect, an unchecked text field. This appears to be a fudge. If EPOSS was properly supporting shared stock units, the stock unit parts (Portions) would be properly registered using administrative functions. Stock Portions are business entities and we have therefore included them on the LDM, however their details do not appear to be stored in the EPOSS 'database'.

4.2.3 POCL Reference Data

POCL Reference Data is used to control the behaviour of the EPOSS system as well as provide details of products, services and accounting structures. The data is passed to Pathway who transform it into a special coded form which is then distributed to all Post Offices.

POCL have produced a logical data model for the reference data. Pathway only describes the data in its coded form. We therefore used the POCL logical data model as primary source for our analysis.

The data model for POCL reference data describes both:

- a generalised network structure that allows any 'node' to participate in multiple hierarchical structures;
- specific business structures such as an Outlet's relationships to such things as contract type, outlet default opening times, outlet language etc.

This is compact in space terms, but difficult for business users to understand and relate to their own requirements. It also hides the difficulty at implementation time of combining attributes together from different entities (e.g. combining address details from Organisational Unit together with Post Office Outlet) or keeping the physical implementation close to the logical model with implied additional costs at implementation and run-time.

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Business functions tend to deal with fixed, not generalised, structures. IT system designers implement databases as generic structures because business changes can be reflected speedily when the business re-organises (which most do regularly!). However, business users need to talk about the functionality in the current structural terms.

It is not clear how much of the POCL maintained reference data is relevant to EPOSS. Some part of the generalised accounting and organisational structures do not look to be supported by EPOSS. The documentation does not clarify this point.

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DOCUMENT CONTROL

Change History

Version	Date	Status	Purpose
1.1	5/3/1999	Draft	Incorporates working papers on BPS and EPOSS. For review by Project Mentors team.
1.2	30/3/1999	Draft	Version for review by Project Mentors team.
1.3	2/4/1999	Draft	Version for review by Project Mentors team. Structure of document modified.
1.4	9/4/1999	Draft	Version for review by Project Mentors team. Contains minor amendments.
1.5	27/4/1999	Provisional	Version for review by Bird & Bird.

Changes Forecast

No changes are expected other than for issues raised by Bird & Bird

Distribution

Project Mentors	Bird & Bird	Benefits Agency	POCL
Andrew Davies	Hamish Sandeson		
Andy Wing			

References

1. Expert Review of BA/POCL Payment Card Programme - Initial Report August 1998, Project Mentors.
2. Selection of Examples of Problems Facing Pathway as set out in Pathway Position Paper dated 6 March 1998
3. Pathway's System Development Approach, Project Mentors document A.41.06
4. Position Paper - Requirements Optimisation, Project Mentors document A.42.07
5. Review of BA/POCL Security Requirements, PA Consulting Group, 13th March 1998
6. Selection of Examples of Problems Facing Pathway As Set Out In The Pathway Position Paper Dated 6 March 1998, undated Pathway paper.

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Source Documents

The following documents provided the information from which the draft analysis was performed.

DSS Documents

CAPS to PAS/CMS Data Interface Definitions and Validation Rules (Post Nile 2)

CAPS to PAS/CMS Codes Files Definition (Release 3)

DDS Agreement Schedule 15 - Requirements

DSS Agreement Schedule 16 - Solutions

DSS Agreement Schedule 01 - Interpretations

POCL Documents

Reference Data Project - Data Model, POCL document RDP/TEC/005 Issue 2.1, 5th January 1998

POCL Agreement Schedule 15 - Requirements

POCL Agreement Schedule 16 - Solutions

Pathway Documents

Functional Specification Version 6.0

Service Architecture Design Document, CR/FSP/0004 Version 5.1

Foreign Encashments CR/FSP/0009 Versions 4 and 5

CCN117 - Supporting Documentation, CR/ION/CCN117

CCN 0083 - One Payment Receipt and One Signature Required for each Transaction (PDA Change Request B0005)

CCN 220 – Restricted PO Indicator Operation

CCN 204a - Generate Card Stop following CMS End of Interest

CAPS Access Service High Level Design, SU/DES/0001

EPOSS Functional Description, BP/FSP/004 Version 3.6

EPOSS Solution Proposal, (no reference) Version 0.5, 07/09/1998

EPOSS Business Rules, EP/DES/008, Version 0.8, 14/10/1998