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FAX TRANSMISSION

To: BA/POCL

Atten\Ref: George McCorkell   Fax No:

cc: Paul Rich, POCL   Fax No: **GRO**
Pat Kelsey, BA/POCL   Fax No:
Andrew Davies, Project Mentors   Fax No:

From: Hamish Sandison

Client: BA/POCL

Account No: BPOCL/001

Date: 18 December 1998

Time:

Number of pages (including this page) : 26

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Please see attached.

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1801

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MEMORANDUM

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TO: George McCorkell, BA
Paul Rich, POCL
Pat Kelsey, BA/POCL Programme

CC: Andrew Davies, Project Mentors (without encs)

FROM: Hamish Sandison, Bird & Bird

DATE: 18 December 1998

RE: PROJECT MENTORS REPORT

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what?

1. Further to my Memorandum dated December 8th, I attach the full report of the work by Andrew Davies and his team on requirements analysis. This fleshes out the brief update from Andrew which I sent you with my December 8th Memorandum. As you will see, all three of Andrew's team are (I quote from Andrew's letter to me) *"deeply concerned that their findings show a serious problem with the way in which ICL Pathway have developed the system. The impact of this is likely to be that there will be failures to meet essential user requirements, causing the need for extensive re-work before the system can be accepted and, potentially, operational problems if the system is rolled out."*

2. As with previous reports, this report is legally privileged on the basis that it has been commissioned by us as the Joint Programme Lawyers. Accordingly, it should be given the most limited possible circulation on a need to know basis.

3. Please do not hesitate to get in touch with me or with Andrew direct if you have any questions or comments.

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Project Mentors

GRO

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December 17, 1998

Mr. Hamish Sandison
Partner
Bird & Bird
90 Fetter Lane
LONDON EC4A 1JP

Dear Hamish,

Independent Consultant Review of BA/POCL Payment Card programme
Privileged and confidential. Prepared in contemplation of litigation
Position paper on Requirements Analysis

We have now completed a provisional version of our position paper on requirements analysis, a copy of which I attach. We are of the opinion that the findings of this paper give serious concern that the Payment Card System has been developed in a manner that creates a breach of the contract relating to the requirement in Clause 702 of the Authorities Agreement to work to 'good industry practice' and that the impact of the breach is likely to be that the system will not be fit for purpose unless extensive re-work is carried out before implementation, causing further delay and additional investment by Pathway and the Authorities.

The following paragraphs summarise the key conclusions from chapter 2 of the paper:

'We have performed a requirements analysis for BPS, which is predominantly a BA system element. From our analysis we conclude that Pathway have made no attempt to undertake requirements analysis in accordance with normal industry practice. This is despite their having access to the SSR and subsequent requirements since April 1996. Much of this work could, and should, have been done during the demonstrator period.

In more specific terms, we conclude that:

- DSS's requirements were complete in scope at the time of contract signing, but incomplete in detail, as was only to be expected;
- only at a detailed level were there gaps and contradictions in the DSS's understanding of their requirements;
- Pathway failed to satisfactorily analyse the DSS's 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 have failed to satisfactorily analyse the DSS's detailed requirements. As a result they have designed and partially built a system without knowing whether it fully meets the DSS's requirements.

Pathway have failed to employ 'good practice' techniques for establishing detailed requirements, in breach of Clause 702 of the Authorities Agreement. None of Pathway's claims that requirements were poorly defined and / or have since been expanded to

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December 17, 1998

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necessitate an optimised solution are sustainable. Indeed, the very examples they have raised add weight to the case that they have failed to undertake satisfactory requirements analysis.

Our experience of systems where requirements have not been analysed satisfactorily is that the system fails to meet the users' needs. An effective acceptance test will identify many such failings, necessitating considerable rework. The result is a significant extension of the time and cost required 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 the failure to satisfactorily analyse the requirements for the Benefits Payments System makes it unlikely that the users needs will be met by the current Pathway system.'

We do not believe, from our understanding of other elements of the complete Payment Card System, that these other elements have been analysed using better techniques than for the Benefits Payment System, so there is a concern that user needs for these elements will also not be met by the current Pathway system.

We would be grateful if you would pass these conclusions to the Authorities so that they may consider their impact on the current deliberations.

Yours sincerely GRO

GRO

Professor Andrew Davies
Director

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Expert Review of BA/POCL Payment Card Programme
Position Paper on Requirements Analysis
December 1998

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Expert review of BA/POCL Payment Card Programme

POSITION PAPER
Requirements Optimisation

Ref: A.42.07 V1.2

Status: Provisional

Prepared By: J Pimpernell / A Wing

Prepared On: 17 Dec 1998

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Expert review of BA/POCL Payment Card Programme
Position paper - Requirements Optimisation

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Position Paper - Requirements Optimisation

1. INTRODUCTION

1.1 Background

As part of the expert review of the BA/POCL Payment Card Programme, we have reviewed ICL Pathway's undated paper of 53 pages entitled "Selection of Examples of Problems Facing Pathway As Set Out In The Pathway Position Paper Dated 6 March 1998". Their paper presents a number of claims about changing and unclear requirements.

Investigation of those claims required us to examine the business requirements expressed at the time of contract signing and compare them against the current understanding of the DSS's requirements. We therefore reviewed documents from both the Authorities and ICL Pathway which contained the definitions of those requirements.

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 selected the Benefits Payment System ("BPS") element of the system as a sample, and assembled a draft requirements analysis.

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

1.2 Purpose of Document

This paper sets out our findings from analysing the requirements from the BPS, in terms of:

* identifying what approach Pathway adopted to establish the detailed business requirements;

* considering the validity and merits of the claims made by Pathway;

* assessing the probable past and future impact of the approach adopted by Pathway.

1.3 Scope

Effective business requirements analysis is needed to achieve a satisfactory, comprehensive business design. This can then be used as the basis for the technical design of the high resilience, high volume system to deliver the required service. We have not been able to consider whether the technical design process has been conducted satisfactorily.

We have to date considered only the BPS system. Further work has recently started to perform a similar assessment of the approach adopted for other elements of the system, such as EPOSS. Nevertheless our findings are, in our view, sufficiently serious to bring into question the whole of Pathway's design process.

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1.4   Structure of Document

In this paper we have set out:

- the conclusions drawn from our analysis of the requirements for BPS, together with the impact we believe the lack of formal requirements analysis has had on development to date and the consequences for the future;

- a broad description of the approach we took in developing our analysis of BPS requirements;

- our findings with respect to the specific requirements related charges made by Pathway.

In Appendix A, we give a brief overview of the nature of requirements specification and analysis.

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2. CONCLUSIONS AND IMPACTS

2.1 Introduction

From the succeeding Chapters of this paper it can be seen that we have performed an initial requirements analysis of the BPS element of the system. We had expected to base this on documents developed by Pathway showing a detailed analysis of the contracted business requirements. Such documents do not appear to exist and we had to base our analysis on the original and current business requirements.

At present, we have no access to Pathway's internal documentation, and consequently cannot tell for certain what Pathway have done in terms of requirements analysis. However, no documents recognisable as formal, or indeed informal, requirements analysis papers appear to have been passed to the Authorities. It is possible that formal analysis has been carried out by Pathway, but we consider this unlikely from what we have seen and from the continuing problems experienced in development of the system.

2.2 Conclusions

It must be remembered that so far we have only performed the requirements analysis for BPS, which is predominantly a BA system element. However, 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 1996. Much of this work could, and should, have been done during the demonstrator period.

In more specific terms, we conclude that:

- DSS's requirements were complete in scope at the time of contract signing, but incomplete in detail, as was only to be expected;

- only at a detailed level were there gaps and contradictions in the DSS's understanding of their requirements;

- Pathway failed to satisfactorily analyse the DSS's 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 have failed to satisfactorily analyse the DSS's detailed requirements. As a result they have designed and partially built a system without knowing whether it fully meets the DSS's requirements;

- Pathway have failed to employ 'good practice' techniques for establishing detailed requirements, in breach of Clause 702 of the Authorities Agreement.

None of Pathway's claims that requirements were poorly defined and / or have since been expanded to necessitate an optimised solution are sustainable. Indeed, the very examples they have raised add weight to the case that they have failed to undertake satisfactory requirements analysis.

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2.3   Impacts on the Programme to Date

2.3.1   Introduction

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 very difficult to design programs in a way which ensures that all system requirements are fully catered for.

2.3.2   "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 which a competent analysis would have identified:

* much more comprehensively;

* much 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.

2.3.3   Estimating and Planning

Requirements analysis is a fundamental requirement for estimating the effort required to develop software. The most accurate estimates can be produced from program specifications, themselves produced from a system specification which is itself derived from detailed requirements analysis. However, there are well accepted tools, such as Function Point Analysis, which enable reasonable estimates to be made from the functions identified during requirements analysis. Without estimates it is not possible to establish resource requirements nor to develop a soundly based schedule.

2.3.4   Other Elements of the System

While we have so far only completed work on the BPS system element, we have grave concerns that the same lack of professional analysis will be apparent in other areas as we come to review them. This concern is supported by a number of interviews with Authorities' staff, from which it is apparent that Pathway are loathe to release design documents to BA/POCL. While they have on occasion cited Intellectual Property Rights as a reason for refusal, we are becoming increasingly suspicious that the real reason is that the right level of documentation simply has not been developed.

Of particular concern is the EPOSS system. We are informed that at a relatively early stage Pathway wanted the Authorities, principally POCL, to be involved with the design of this element. The plan was to use the Rapid Application Development

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("RAD") methodology to design this system. This approach was started, but discontinued after some months, when the Pathway staff member involved left the project. The suggestion to use RAD leads us to believe that more traditional methods have not been used, and since the RAD experiment was abandoned, we have doubts whether any proper requirements analysis has been performed.

2.4 Impacts on the Programme in the Future

Our experience of systems where requirements have not been analysed satisfactorily is that the system fails to meet the users' needs. An effective acceptance test will identify many such failings necessitating considerable rework. The result is a significant extension of the time and cost required 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 the failure to satisfactorily analyse the requirements for the Benefits Payments System makes it unlikely that the users needs will be met by the current Pathway system.

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3.   APPROACH

3.1   Assessment of Pathway "Examples"

Many of the examples quoted in Pathway's paper claim that initial definition of requirements was of poor quality, and / or that there has been subsequent expansion of those requirements. To assess the validity of those claims, we needed to compare the requirements as defined at the award of contract with the current definition of those requirements.

As set out in Appendix A, 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 staff at Terminal House, Norcross and Longbenton failed to identify any unrecorded but relevant documents.

We therefore examined the Pathway documents set out in Table 2.1 below, to assess whether they in whole or in part could be considered as supporting Requirements Analysis.

Table 2.1 - Pathway Documents Reviewed

Document
Functional Specification Version 6.0
SADD Version 4.0
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

Where detailed definition of requirements exists, it is distributed across the multiple documents identified and defined using different techniques.

In the absence of formal requirements analysis specifications, we constructed a draft detailed analysis against which we could examine each Pathway claim.

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3.2 Draft Requirements Analysis

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 draft in December 1995, and as a final version 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 used the SSR to draw up a Logical Data Model ("LDM") and Data Flow Diagrams ("DFDs"), both well understood tools common to most formal analysis methods. Appendix A sets out a more detailed description of requirements analysis. This provided us with a detailed analysis of the original requirements.

Once the initial analysis was complete, we reviewed other available documents to determine if these changed the analysis in any significant way. The documents reviewed at this stage were principally those produced by Pathway, although we also considered a number of CAPS definition documents. During this second stage we also produced definitions of the principal functions. These are written using indentations to show a logical structure, often described as structured English.

3.3 Changes Found

Once the requirements analysis was completed, we compared the LDMs and DFDs based on the SSR with their equivalents derived from the current status. We found no changes of any real substance, although, as would be expected:

* there was more detail in the later LDM, but noticeably only in terms of their being additional attributes to each of the data entities. There were <u>no</u> new data entities;

* the functionality (as depicted in the DFDs) was little changed, and in the main such changes as there were reflected the identification of processes to deal with exception conditions.

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

In our view, the changes found would have been identified by any reasonably competent analyst following the methods we used or any of the major methods widely available. Given the SSR as background, and the little time required, we consider much of the functional requirements analysis could have been completed by suppliers before the contract was awarded.

3.4 Time Scale

Our analysis took four weeks effort from a single consultant, spread over a period of two months. Research on other issues occupied the remainder of his time.

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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

While acknowledging that the above work has so far only been completed for BPS, we believe the small amount of time required suggests that the business functionality of this element of the whole system is far from complex, and can be easily and rigorously modelled using standard tools.

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4. FINDINGS

The Authorities have provided their own responses to the issues raised within the Pathway paper. Of the 10 items presented in the paper, the following are related to DSS requirements:

* Extended Verification Procedure
* Foreign Encashment Rules
* DSS Reference Data
* Contradictory and Misleading Requirements
* Change Control Issues

4.1 Extended Verification Procedure

4.1.1 Issue

The early history of EVP requirements definition illustrates the Authorities' interference in design, and enhancement of the contractual requirements."

4.1.2 Analysis

Pathway's statement of the issue says it all - *"The contractual requirements for the Extended Verification Procedure (EVP) are vague and lack sufficient definition for Pathway to develop its solution....".* This being the case, why did Pathway fail to take steps to establish the detailed requirements?

4.2 Foreign Encashments

4.2.1 Issue

"The Authorities failed to comprehensively express their business rules for foreign encashments which Pathway required to know in order to develop Benefit Encashment Service ("BES") functionality. The foreign encashment related requirements are poorly defined and of limited use. Pathway has been forced to define foreign encashment business rules for the DSS. These difficulties have been compounded by the PDA's failure to properly manage this issue."

Pathway's summary of what happened:

"The DSS's inconsistent approach to its own business rules in this regard became clear in the course of workshops during October 1996. Pathway produced a document interpreting DSS foreign encashment rules in December 1996, after which extensive comments have continued to be received from the DSS and the PDA, some conflicting, suggesting alternative rules. Version 5 of Pathway's Foreign Encashment Paper is currently under review."

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4.2.2   Analysis

The following observations can be made:

- As the Authorities had failed to comprehensively express their business rules, why had Pathway not produced the detailed analysis that would have revealed the gap?

- Why did it take until October 1996 to convene workshops to address foreign encashments when the contract was signed in May of that year

- Why did it take a further 18 months to get to version 5 of the document that was still to be agreed? Only a relatively small piece of logic is necessary to describe the requirement. This does not require 18 months work.

4.3   DSS Reference Data

4.3.1   Issue

"Contractual requirements in response of DSS: Reference data are virtually non-existent. Pathway has had to seek and reconcile extensive information in respect of DSS reference Data from 3 organisations (CAPS, ITSA and Electronic Data Systems (EDS)) in order to develop its solution. These organisations have not adopted a uniform or co-ordinated approach to the issue and Pathway has, in effect, been carrying out the DSS' work of analysis in this area. Information has been lacking, inconsistent between the 3 organisations, and generally of poor quality. This has involved Pathway in extensive analytical work not envisaged under the Related Agreements, abortive work and re-work, involving cost and delay. The Authorities have sought to optimise and enhance the existing contractual Reference Data requirements."

4.3.2   Analysis

If Pathway had performed the detailed data analysis, the 'reference' entities would have been identified and specifications established with DSS. Because the definitions need to be complete and precise, any gaps would have been identified at an early stage and appropriate steps taken to fill the gaps. (There are some 12 sets of definitions passed by CAPS to PAS/CMS relating to business reference data. All are identified in the data model and could have been defined in detail during the analysis).

The issue of *'no single point of responsibility within the DSS. Responsibility was dispersed across three organisations: CAPS, ITSA and EDS.'* is probably valid. However, the analysis would have allowed Pathway to say "this is the data, who is supplying it and in what form?".

Pathway fail to distinguish between the definition of data as against the specific values the data can take e.g. 'Payee Role Description is a 20 character alpha numeric attribute' and 'Payee Role Description can take the values "Beneficiary", "Appointee" etc. The first is always important for specification and design. The second is only important where specific values or ranges of values are identified in

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the detailed specification of the IT system e.g. 'if the Payee Role Description is "Beneficiary" then do X else if the Payee Role Description is 'Appointee' then do Y'.

A logical data model identifies which attributes are mandatory and which are optional. Certain attributes in the reference data are optional. For Pathway to state that *"This only started to become apparent in about August 1997 when Pathway received test data"* is in effect a clear admission of the failure to analyse requirements satisfactorily.

4.4 Contradictory and Misleading Requirements

4.4.1 Issue

"A number of the Authorities contractual requirements contradict other contractual requirements, or do not accurately describe what the authorities have subsequently articulated to be their requirements. For example, requirement 943/3 states that when a customer is no longer to be supported by the Card Management Service (CMS), an 'end of interest' notice will be sent to Pathway by the DSS. Pathway must react to this notice by implementing a permanent card stop for that customer. This potentially causes conflict with requirement 954 which requires that an old card be re-used when personal details are sent to Pathway for a customer against whom there has been a previous card stop. Requirement 934/3 also potentially conflicts with requirement 716 and the Service Interface Definition dated 9 February 1996. A further example of conflict is the requirements relating to summarised receipts. In each case, the conflicting requirements cause Pathway's work programme to be delayed and disrupted whilst the requirements are analysed and the position clarified with the PDA and the Authorities. The difficulty is exacerbated by the PDA's and the Authorities' lack of appreciation of the consequences of attempting to apply, often ill-defined, operational rules and procedures used in the existing paper based system to the new automated system."

4.4.2 Analysis

It is unavoidable that requirements expressed before analysis will contain gaps and inconsistencies. This is a fundamental reason for performing the requirements analysis at the earliest opportunity. If Pathway had performed the analysis early in the project, the contradictions would have surfaced, been resolved and design and development work progressed without the disruption they allege took place. Pathway should have recognised that without the analysis there would be a high risk of design re-work.

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4.5   Change Control Issues

Three examples are quoted by Pathway:

* Temporary Tokens & Casual Agents (CCN117)
* Unmatched Encashments
* Continuation Receipts

However, each relates to the following primary issue raised by Pathway.

4.5.1   Issue

"The conduct of the Authorities and the PDA in dealing with a number of change control issues has often created significant problems for Pathway. The Authorities' lack of knowledge of their own real requirements; conflict between the Authorities and their requirements; an inconsistent approach by the Authorities to Pathway; the PDA's failure to properly manage the change control process; and prolonged negotiations between Pathway and the PDA over change control time, cost and requirement issues have adversely affected Pathway's ability to develop the solution. Pathway has been faced with extensive delay, increased costs, abortive work and re-work.

4.5.2   Analysis

Change control is an essential component of an IT development. However, where requirements are imprecise there is significant room for interpretation and change of interpretation by the parties involved. A detailed requirements analysis will provide the focus for discussion of those requirements, with no room for different interpretations. The lack of such an analysis for the Card Programme provided fertile ground for extended negotiations over changes. The requirements were never 'nailed to the floor'.

As indicated elsewhere, this process of analysis could and should have been started by Pathway during the procurement phase. To complain about the issue two years later shows poor management and technical direction.

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APPENDICES

A   REQUIREMENTS ANALYSIS

A1   What are Business Requirements?

Most IT systems are built to support businesses and organisations in carrying out their aims. There are two main classes of people involved in installing a new IT system, Business Specialists and IT Specialists. These two groups have very different sets of skills and knowledge.

- The business specialist understands what the business does, how it works and what challenges are facing the organisation. They are business focused. Their expertise in IT will seldom go beyond using a word processing package or spreadsheet.

- The IT specialist designs, builds and tests IT systems. Their particular area of expertise is focused on computer software and hardware. They may have some knowledge of the particular business area in which they are working, however they are not the experts. Indeed, having completed one IT system they will often develop another for a totally different application.

This has been true since the earliest computer systems and is still true today. However, although they must work closely together, they have found it difficult to communicate ideas, definitions and agreements about what the business objectives are, and how the computer solution will meet the business needs. They might have a common language, in say English, but each has their own extensive jargon. They use the same words to mean different things and have different words to mean the same thing. The opportunities for misunderstanding are legion.

The early 1970s saw the first steps in establishing a standard set of activities and techniques which could be followed by both groups and were thus a means of reaching a common understanding of the business requirement and the computer solution. These have evolved over the years, however the fundamental approach has not changed, nor have the basic techniques used during the process. The steps can be summarised as follows:

1. Establish the business requirements;
2. Specify an IT solution which meets these requirements;
3. Develop the IT solution to the specification;
4. Implement the IT solution within the business.

Like a production line, the products of each activity are input to the next activity. Different mixes of skills are required for each activity. For example, in activity 1 business knowledge is particularly important whereas in activity 3, specialist expertise in IT is the primary need.

However, it is not just the sequence of steps that is important. During each stage, specially developed techniques are used to establish shared understanding and from that agreement on what the IT solution will do and how it will address the business needs.

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A2 Identifying the Requirements

A2.1 Statement of Requirements

The first step will be to for the business to construct an agreed definition of the scope and broad functionality of the required IT system. In the case of BA/POCL this was the SSR, which was later formalised as the contract requirements catalogue. Such documents can be used as a first step in specifying the IT solution. However, the level of detail supplied about business processes, business rules and business data is not enough to allow the IT specialist to complete the specification of the system to allow detailed design and development to be performed. A further step of analysing the requirements is essential.

A2.2 Analysis of Requirements

Three areas need to be addressed:

1. The information about the business that needs to be held within the IT system

2. The business rules that have to be followed by the programs within the IT system

3. The business events that will cause particular programs to be executed in the IT system

The analysis needs to be performed by specialists skilled in the use of particular tools and techniques that have been developed specifically for this task. Two techniques are particularly important:

1. Logical Data Analysis - a technique used to produce a complete and unambiguous definition (the Logical Data Model) of all the business data that is to be stored and manipulated within the new IT system.

2. Functional Analysis - a process to ensure that the business rules for manipulating the business data defined in the logical data model are also complete and unambiguous.

Note that both forms of analysis are focusing on the business requirements and do not address issues of how the IT system is to be designed. Indeed, it is possible to perform the two activities without a view to implementing a computer system at all. However, it is often appropriate to identify some constraints on the type of solution being sought e.g. the system software needs to be the same as existing IT systems; the 'look and feel' of the computer screen/ keyboard should be consistent with company standards; for what period the system is to be 'available' each day. Such requirements should be kept clearly separated from the business requirements.

The final product of the analysis should be a requirements trace which identifies how every requirement in the requirements catalogue is embodied in the analysis.

A3 Requirements Analysis Methods

A detailed requirements analysis will, at a minimum, contain the following:

- Logical Data Model
- Data Flow Diagrams

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- Functional Description in Structured English

- Constraints on design and operation

Individual authors and commercial organisations have developed and sold named methods. Some are no more than descriptions in books. Others are fully fledged packages of documentation, software tools and training packages. Some focus only on the requirements analysis process, others cover the complete IT life cycle from strategy through to live support. A list of some of these is presented in Appendix B.

However, even though the scope varies, they have similar underlying principles and techniques when considering requirements analysis.

The UK government's Central Computer and Telecommunications Agency (CCTA) recognised the importance of using appropriate methods. It employed LBMS to enhance its LSDM method to develop SSADM - Structured System Analysis and Design Method. This is now the standard method used by Government departments. It is also very popular in industry with a wealth of people experienced in its use.

A3.1 Logical Data Model ("LDM")

This is a complete and unambiguous definition of all the business data that is to be held within the computer system. It defines:

- the business objects of interest e.g. Customer, Authorised Payment, Encashment. The general term for business objects is 'entity types'

- the attributes of interest for each entity type e.g. for the Customer entity we will want to record the customer's NINO, surname, nominated post office etc. The definition for each attribute will be at a detailed level. The type of attribute - numeric, alpha-numeric, etc., the maximum length, whether it must have a value or is optional, whether it has a fixed range of values and what they are e.g. a Customer's Geographical Restriction indicator may only have one of a small number of values, each of which has a specific meaning. It is also essential to specify which attribute can be used to uniquely identify a particular instance of an entity e.g. a Post Office is identified by a FAD attribute.

- the relationships which exist between entity types and the nature of those relationships e.g. A Customer may be the beneficiary of one or more Authorised Payments, but an Authorised Payment must be for a single Customer (as beneficiary).

This information is recorded within a Data Dictionary.

Entity Relationship Diagrams are used to provide a graphical representation of the entities and the relationships between them. This is useful both for providing an overview of the contents of the data dictionary, but also, and more importantly, as a means of communication and agreement between business and IT specialists.

The Logical Data Model is the single most important product of the development process if misunderstanding and delay is to be avoided.

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2   Data Flow Diagrams ("DFDs")

The computer will need to support and implement selected business functions. These business functions take data as input, perform some actions upon it and deliver some results e.g. The Encash Payments business function might identify the payments for a selected customer, make the encashment, mark each payment as 'encashed' and produce a receipt.

As their name suggests, DFDs describe how data flows between the various business functions to be implemented in the computer system. It also identifies the 'events' on the boundary of the new system which will cause something to be done within the computer system e.g. a Post Office has been temporarily closed. This event needs to be fed to a function of the system to change the recorded status of the Post Office to 'temporarily closed'.

The process of building the DFD allows common functions to be identified (i.e. things that are done for more than one reason) so that a single description of the function can be produced. Examination of the data that flows between the functions also helps identify any data that might have been missed in the Logical Data Model. Where flows have a complex sequence of data items, these will be described in detail using structure diagrams.

A3.3   Functions Described in Structured English

A computer programmer needs a complete and unambiguous definition of the business functions that are to be replicated in the computer programs. Narrative descriptions are inadequate. Structured English (sometimes known as pseudo-code) allows for precise definitions that both business and IT specialists can understand. A simple example might be:

```
If
        The payment's first-payment-due-date is less than or equal to today
        And
        The payment's payment-expiry-date is equal to or greater than today
Then
        Encash the payment
End-If
```

The functional descriptions refer to the entity types and their attributes as identified in the logical data model. This may be supplemented by lists and tables, but the Structured English is essential for unambiguous definition of business rules. Items missing from the logical data model are also identified during this activity.

A3.4   Constraints

The components of the requirements analysis described above are in business terms only. Indeed, they could be produced without consideration of the computer solution. However, it is often the case that the business organisation already has IT systems with which the new system is to communicate, or has standards for such components as computer operating systems. These need to be clearly identified and recorded so that the IT designers may take them into account when producing the detailed design of their solution.

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A3.5   Operational Characteristics

The business will identify minimum performance targets for the functions implemented in the new computer system e.g "The encashable payments for a customer must be presented on the screen within 2 seconds of the entry of the customer's NINO", or "Urgent Payments must be visible at the counter of the nominated Post Office within 30 minutes of their presentation to PAS".

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B   DOCUMENT CONTROL

B1   Change History

Version	Date	Status	Purpose
1.1	15/12/1998	Draft	For review by Project Mentors team.
1.2	17/12/1998	Provisional	For presentation to Bird & Bird and Authorities

B2   Changes Forecast

None expected

B3   Distribution

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

B4   Glossary

Analysis	Defining the purpose, objectives, and requirements for the application.
Design	The translation of application requirements into a particular technological implementation.
SSADM	Structured System Analysis and Design Method was developed by the Government's Central Computer and Telecommunications Agency (CCTA). SSADM version 1 was introduced in 1981; the current version, 4.0, was most recently modified in the mid-90s. SSADM provides a systematic approach to analysis and design of information technology (IT) applications. It is the standard for software development in all departments of the Government.

B5   References

1. Selection of Examples of Problems Facing Pathway as set out in Pathway Position Paper dated 6 March 1998

2. Structured Analysis and System Specification, Tom DeMarco, Yourdon Press, Englewood Cliffs, NJ: 1979.

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3. Structured Systems Analysis: Tools and Techniques, Chris Gane and Trish Sarson, Prentice-Hall Inc., Englewood Cliffs, NJ, 1979.

4. Modern Structured Analysis, Edward Yourdon, Yourdon Press Englewood Cliffs, NJ:, 1989.

5. SSADM, CCTA

6. IEW, Ernst & Young

7. Method 1, Anderson Consulting

8. 4 Front, Deloitte Consulting Group

B6   Documents

Document
CAPS to PAS/CMS data Interface Definitions and Validation Rules (Post Nile 2)
CAPS to PAS/CMS Codes Files Definition (Release 3)

Prepared by Project Mentors Ltd., acting as
sub-contractors to Bird & Bird, Solicitors

Ref: A.42.07 V1.2
Status: Provisional

Date: 17 Dec 1998

→ Janey, as requested.
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MEMORANDUM

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TO: George McCorkell, BA
        Paul Rich, POCL
        Pat Kelsey, BA/POCL Programme

CC: Andrew Davies, Project Mentors (without encs)
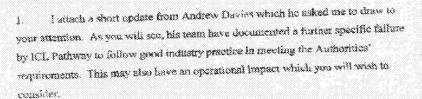
FROM: Hamish Sandison, Bird & Bird

DATE: 8 December 1998

RE: PROJECT MENTORS UPDATE

COPY

1.   I attach a short update from Andrew Davies which he asked me to draw to your attention. As you will see, his team have documented a further specific failure by ICL Pathway to follow good industry practice in meeting the Authorities' requirements. This may also have an operational impact which you will wish to consider.

2.   Andrew will be preparing a more detailed report by the end of next week, but I thought that you should see his summary immediately.

3.   As with previous reports, this update is legally privileged on the basis that it has been commissioned by us as the Joint Programme Lawyers. Accordingly, it should be given the most limited possible circulation on a need to know basis.

4.   Please do not hesitate to get in touch with me or with Andrew direct if you have any questions or comments

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