



**Qualifications and Curriculum Authority
(QCA)**

in association with

**Council for the Curriculum Examinations and
Assessment (CCEA)**

**Awdurdod Cymwysterau Cwricwlwm Ac Aseu Cymru
(ACCAC)**

Scottish Qualifications Authority (SQA)

Invest To Save Budget Bid

**External Marking and Data Collection
Process Improvement for Tests and Examinations**

**INVEST TO SAVE BUDGET
PRO FORMA FOR ROUND 3 FORMAL BIDS**

ASSESSMENT SHEET

BID NO xx

Summary details

<i>Project title</i>	External Marking and National Data Collection -Process for Improvement for National Tests
<i>Parties to project (lead partner in bold)</i>	<p>Qualifications and Curriculum Authority (QCA)</p> <p>Council for the Curriculum Examinations and Assessment (CCEA)</p> <p>Awdurdod Cymwysterau Cwricwlwm Ac Asesu Cymru (ACCAC)</p> <p>Scottish Qualifications Authority (SQA)</p>
<i>Objectives of project</i>	<p>The objective of this programme of projects is to improve speed, efficiency, accuracy and value for money in test and examinations on marking and collection of pupils' results across England, Wales, Northern Ireland and Scotland. The purpose will be to redesign the existing marking and data collection systems to:</p> <ul style="list-style-type: none"> • offer increased flexibility; • improve operability; • reduce the time taken for the circulation and marking of papers; • increase ease of use by markers and schools alike; and • lead to an overall reduction in costs.
<i>Description of project</i>	The programme comprises a number of interfaced projects which will redesign the existing traditional, paper-based marking and data capture processes to produce a redesigned model involving electronic imaging, marking and direct data capture.

<i>Round 3 theme (secretariat use only)</i>	<i>Policy category (secretariat use only)</i>			
<i>ISB funding sought</i>	£	01/02	202/03	03/04
	Current	1,069,000	1,020,000	749,000
	Capital	0	0	0
	Total	1,069,000	1,020,000	749,000

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Appendix 1 Risk Assessment

Executive Summary

The regulatory authorities for assessment and qualifications in England, Northern Ireland, Wales and Scotland are jointly submitting this bid for Invest to Save Budget (ISB) funding from the Treasury.

Funding is sought for a number of interfaced projects which will redesign the existing traditional, paper-based marking and data capture processes to produce a redesigned model involving electronic imaging, marking and direct data capture.

Without redesigning existing processes using new technologies current levels of efficiency and cost cannot be improved.

The proposal is cutting edge and therefore involves significant innovation. There is no comparable process on a similar operational scale to that anticipated here anywhere else in the world.

The objective of this programme of projects is to improve speed and efficiency, accuracy and value for money in test and examination marking and collection of pupils' results across England, Northern Ireland, Scotland and Wales. The purpose of the project will be to:

- offer increased flexibility;
- improve operability;
- reduce the time taken for the circulation and marking of papers;
- increase ease of use by markers and schools alike; and
- lead to an overall reduction in costs.

The bidder will allocate resources of £335k in the first year and £310k in subsequent years to this project, representing a total of 25% of the total project value. The total funding required is £3,793,000.

If all projects are accepted and implemented, savings downstream will be in the region of over £2 million per annum, with a positive NPV of £7.41 million over ten years.

Risks have been identified and assessed. However, we believe these are manageable.

1 Introduction

1.1 The regulatory authorities for assessment and qualifications in England, Northern Ireland, Wales and Scotland are jointly submitting this bid for Invest to Save Budget (ISB) funding from the Treasury. The partner bodies are:

England	Northern Ireland	Wales	Scotland
Qualifications and Curriculum Authority (QCA) [<i>Lead Body</i>]	Council for the Curriculum Examinations and Assessment (CCEA)	Awdurdod Cymwysterau Cwricwlwm Ac Asesu Cymru (ACCAC)	Scottish Qualifications Authority (SQA)
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(NB: Throughout the paper the above bodies are referred to collectively as the regulatory authorities.)

1.2 Funding is sought for a number of interfaced projects which will redesign the existing traditional, paper-based marking and data capture processes to produce a redesigned model involving electronic imaging, marking and direct data capture.

1.3 The benefits will address both policy and operational issues applicable to all regulatory authorities, in particular focussing on:

- improving the speed and quality of marking and processing;
- reducing burdens on schools;
- improving administrative service to schools;
- relieving pressures on organisations to recruit suitably qualified markers; and
- maintaining confidence in the testing process.

1.4 Without redesigning existing processes using new technologies no further efficiencies are likely to arise and overall costs cannot be reduced.

1.5 The proposal is cutting edge and therefore involves significant innovation. There is no comparable process on a similar operational scale to that anticipated here anywhere else in the world.

2 Objectives of Project

Objectives of the Project

- 2.1 The objective of this programme of projects is to improve speed and efficiency, accuracy and value for money in test and examination marking and collection of pupils' results across England, Northern Ireland, Scotland and Wales. The purpose of the project will be to:
- offer increased flexibility;
 - improve operability;
 - reduce the time taken for the circulation and marking of papers;
 - increase ease of use by markers and schools alike; and
 - lead to an overall reduction in costs.
- 2.2 Many of the projects will develop solutions that can be shared amongst testing bodies. This would make some projects economically feasible that would otherwise be difficult to justify on cost/benefit terms, and would permit sharing of projects across organisations, so that parallel development or improvement could take place.
- 2.3 However, as this project is pushing the boundaries of current technology, it may be that some of the options proposed as solutions will not work in the way anticipated. Decisions about viability of all options will have to be taken which may result in some not being developed further. This outcome must be seen as positive and part-and-parcel of the innovative approaches being suggested.
- 2.4 As the implementation of the proposed change programme involves using latest technologies, this should also provide a platform to enable the regulatory authorities to take advantage of future developments in technology. The regulatory authorities will need to keep abreast of latest technologies to ensure that the systems implemented do not later become obsolete.

Background

- 2.5 QCA's statutory duty is to advise the Secretary of State for Education and Employment on all matters affecting the school curriculum, pupil assessment and publicly funded qualifications offered in schools, colleges and workplaces. ACCAC has similar responsibilities in Wales. In Scotland the SQA is the statutory awarding body responsible for developing qualifications in line with Government policy, for managing the qualification and assessment system and for making awards to candidates. (It also has a separate accreditation function for SVQs.) CCEA has a statutory duty to advise the Education Minister in Northern Ireland on all matters affecting the curriculum for those in full time education up to the age of 19, pupil assessment and accredited qualifications (General and Vocationally-related). Through these functions, the regulatory authorities contribute to the development of public policy on education and training.
- 2.6 One key aspect of the assessment process is the marking of test papers and the collection of results. In England, QCA is responsible for the organisation, marking and collection of national data for the statutory national curriculum tests at key stage 2 (11 year olds), key stage 3 (14 year olds). The tests involve some 600,000 pupils in each age cohort in around 16,500 schools at key stage 2 and 4,500 schools at key stage 3 across England and other non-UK schools following the National Curriculum. In addition, in 2001 QCA will be responsible for marking and collecting test data for approximately 150,000 pupils in the year 7 progress tests in English and mathematics. In Northern Ireland and Wales, tests for key stages 2 and 3 are set and marked for approximately 60,000 pupils. The ACCAC is responsible for marking and collecting test data for approximately 1,500 schools, 39,000 pupils, 375 markers for key stage 2 and 280 schools, 36,000 pupils and 410 markers for key stage 3. In Scotland, tests at a similar age and stage are internally assessed

and, although SQA develops and distributes the test materials, it does not collect assessment data other than for moderation purposes. (However, there could be more general applications for the SQA. The age group is typically 61,000.)

Current Situation

2.7 There are four main elements in the design and administration of the national tests. These follow traditional methods of large-scale test administration which rely almost entirely on ‘shifting paper’, namely:

- design of the tests (performed by test development agencies);
- administration of the tests and teacher assessments (by schools);
- external marking of test scripts (managed by external marking agencies); and
- collection of results data (managed by the national data collection agency).

(The key stage 2 tests in Northern Ireland are marked by the teachers in schools.)

2.8 The current process has operated since 1996 and, although working well, needs to be revised in order to improve speed and efficiency, accuracy and value for money.

2.9 The process is highly visible to the public and media, and the Government will face embarrassment if, for any reason, the process encounters significant problems or delays. This potential risk will be taken into account when planning and implementing redesign. The approach will be to ensure the process is implemented in a controlled manner, so that each test cycle has a low risk of failure. This has implications for thoroughly testing each proposed improvement, with built-in fallback options should the proposed improvement fail.

Our Solution

2.10 Eight projects have been identified to deliver improvements to the current process. These are as follows.

On-line Marking (centralised or web-based): With centralised marking a centre is appointed for a given period and markers attend for a number of specific hours. Work will be organised into batches so as to ensure completion within the allocated time. Supervisors and facilities are provided on-site.

Web-based marking takes the basics of the centralised marking system approach and configures this for delivery over the web. This will allow markers to participate from home, or at another centre, where computer access is available in “virtual” marking centres. This solution will require the development of a system to allocate and supervise work on-line, to train markers and to ensure the system operates to an acceptable level of performance.

There are also a number of areas where computer support can be helpful, and these will be introduced gradually from cycle to cycle. The key features of these improvements are to enable:

- script scanning to take place to capture pupils’ answers as digital images for later storage and processing;
- to be undertaken with double marking of pupils’ answers and reconcile any differences;
- the re-training of markers whose marking standards may be suspect to enable them to continue marking to the correct standard;
- the separation of individual questions from scripts to enable marker expertise to be focussed on particular topics;
- computer-assisted marking for simpler questions, i.e. single-word and multiple-choice answers.

On-line Training of Markers: The current process trains markers in the marking scheme for each paper. This is in the form of a one-day course. To cover the 11,000 markers, this requires a complex and costly structure of both training the trainers and scheduling markers to attend training meetings. On-line training will allow courses to be provided as a series of computer-based presentations and exercises with interactive elements provided on-line via discussion groups and broadcast sessions. The result should be a more consistent level of training for all markers, and the provision of training at more convenient times. The key features of this improvement are to enable:

- a range of course modules to be available depending upon each marker's needs;
- testing on-line to assess markers for appointment (especially for non-teacher markers);
- facilitation of discussion groups or broadcasts from question setters;
- e-mail correspondence between markers and marking agencies.

Personalised Scripts for Schools: This solution will prepare pre-printed answer papers for each test. These will be personalised, with identification numbers printed on each answer sheet. Sets of answer books will be sent to the schools for distribution to pupils as tests are taken. Tracking the issue and return of scripts will aid the administration of the process. The key features of this improvement are to enable:

- pre-printing of all scripts with unique pupil identifiers in place to support easy scanning;
- control mechanisms to be introduced to ensure tests, scripts and registrations reconcile.

Change Management: Many of the initiatives represent significant change to the marking process. These changes will need to be managed sensitively in order to ensure they are accepted by the public and properly used by the school and marker population. The key features of this improvement are to enable:

- the assessment of readiness for change of all participants in the programme;
- the preparation and execution of a communication plan;
- the preparation and execution of a change management plan;
- the monitoring of the change process.

Management Information and Reporting: The suggested improvements will provide the ability to generate information about the process. This information can be used to provide information externally to the public (school performance measures), to manage the performance of the process (developed from current process performance statistics) and to support the assessment of how well the benefits of the process have been realised. System support will be required to extract the volume of data needed and to support ad-hoc queries and analysis. The key features of this improvement are to enable:

- process performance figures for management to be made available;
- the analysis of performance in a way which is consistent with the business cases, future vision, and current initiatives;
- the provision of information on the performance of each supplier;
- the provision of data for key users, such as schools, LEAs and parents.

Interface with DfEE's Information Management Strategy Project: The DfEE is running a project to define data sets to be held by educational establishments. These data sets will be published as a standard and will permit a number of software suppliers to develop systems to hold them. The key benefit of this project will be the standardisation of record keeping, both in the format of data held and in the semantic meaning of each data element. The key features of this improvement are to enable:

- the straightforward download of all school and pupil data from data sets planned by DfEE;
- the Government's aims of interoperability to be maintained nationally.

Develop Management Framework: This initiative will prepare a management framework for managing the live programme with development initiatives running in parallel. This will involve adopting PRINCE2 for the management of the process, rolling the method out for use by suppliers and adopting good practices for contract management. A set of standard contracts and service level agreements for use in the administration of suppliers will be developed. A model will also be developed for use in calculating and verifying the business benefits sought from each initiative as well as developing supporting materials for use in communicating the new process vision to stakeholders. The key features of this improvement are to enable:

- a management model for the process to be defined;
- the tracking and control processes to be defined.
- the preparation of supporting documentation – specifications and service level agreements;

On-line Delivery of Test Papers: This initiative enables direct local delivery of test papers to schools over the web thus allowing schools to download papers on the day of tests. The key features of this improvement are to enable:

- the speed of delivery to be increased, thus reducing cycle time;
- schools to select tests locally to allow for specific targeting of difficulty for pupils; and
- sensitivity and security to be increased;
- access to be improved.

Relationship with Modernising Government Agenda

- 2.11 The project accords with the themes set out in the White Paper on Modernising Government, in particular, it focuses on providing a more flexible service, a more automated service so reducing paper burdens, a more seamless approach across all parties involved in the testing and marking process and a better value service. Customers and parties involved, will be consulted during implementation to ensure the system meets users needs.

3 Funding Requirements for Project

Funding Requirements

3.1 The following table presents the funding profile for the project.

	2001-2002	2002-2003	2003-2004
ISB Funding	£1,069,000	£1,020,000	£749,000
Of which: current	£1,069,000	£1,020,000	£749,000
Of which: capital	£0	£0	£0
Subtotal	£1,069,000	£1,020,000	£749,000
Bidder's own funding	-	-	-
QCA	£200,000	£200,000	£200,000
SQA	£60,000	£60,000	£60,000
ACCAC	£25,000	To be confirmed	To be confirmed
CCEA	£50,000	£50,000	£50,000
<i>Total Bidder Funding</i>	<i>£335,000</i>	<i>£310,000</i>	<i>£310,000</i>
<i>Of which:</i>			
- <i>Current</i>	<i>£335,000</i>	<i>£310,000</i>	<i>£310,000</i>
- <i>Capital</i>	<i>£0</i>	<i>£0</i>	<i>£0</i>
TOTALS	£1,404,000	£1,330,000	£1,059,000

3.2 As can be seen from the table the bidder will allocate resources of £335k in the first year and £310k in subsequent years of this project, representing a total of 25% of the total project value.

3.3 The regulatory authorities can accept a different profile than the one presented above. However, if less funding were allocated there would be an impact on the speed of implementation and the scope of what can be achieved. It is not possible for the bidders to increase their contribution to the project.

3.4 As the whole project is made up of a number of smaller projects it would be possible to proceed on a smaller scale. However, the key objective of the project is to move the marking process on-line.

4 Innovation

4.1 This programme is innovative in that it aims to take a number of existing and developing technologies and combine them to deliver support systems and processes for a large-scale assessment nationally. The process developed, if successful, could be used to benefit other organisations within the public sector, especially within other awarding bodies. A number of these innovations have had some early testing performed by other organisations, especially awarding bodies. However, this project will be the first to trial the new approaches in an integrated and large-scale way. The following innovations are proposed:

- scanning test scripts;
- on-line training of markers;
- on-line delivery of test papers;
- on-line marking of tests;
- profiling pupil and school performance; and
- allow future electronic architecture.

4.2 Following delivery of test scripts, these will be scanned and the pupils answers captured as digital images. Each pupil's set of complete answers will be held in a database, which can subsequently be presented to markers for marking on a PC. Software will be developed which can segment pupils scripts into images of

individual questions that can be delivered to markers according to marking specialism. These scanned images will then be batched and marked on-line.

- 4.3 The basic idea outlined above can be expanded to support different types of question and also support the use of different types of markers. It should also aid double marking, where a question is marked twice and the marks compared.
- 4.4 Initially marking may be offered at marking centres where appropriate computer support can be installed and operated. Over time this technology will move to home use – where markers will access the web directly from their home or teacher resource centre and mark on-line. The training of markers will also, in future, use the web to deliver the training, either as a substitute for existing training, or as a supplement. This has been found to be effective in certain circumstances and extremely cost effective with large numbers of trainees. This will enable a wider range of training than currently delivered, the possibility of testing new markers for marking and have the benefit of not requiring attendance for classroom training. QCA is aware of practical research already being undertaken by the Open University in this area.
- 4.5 Upon marking, the item level marks will be used to derive a profile of performance for an individual pupil, class, school or year group. Given this information, and the cohort performance nationally, a pupil can be assessed for areas of relative weakness and strength. It is anticipated that the ability to produce such analyses will in turn provide useful feedback for the test preparation exercise to produce test profiles that better support such analyses.
- 4.6 The innovations proposed above will require electronic architecture, which combines the features of each of the projects into a single integrated solution. Once achieved, the innovation opens further possibilities for enhancing the process – from expanding to accommodate other tests, to providing the background for later introduction of on-line testing.
- 4.7 The regulatory authorities are encouraged by developments overseas in this area, in particularly in the USA where some similar systems already exist. Piloting of similar systems is also being undertaken in Victoria, Australia. Current work for testing teachers in training commissioned by the Teacher Training Agency (TTA) makes use of features similar in approach. None, however, undertake work on the scale proposed. The regulatory authorities are preparing to run a prototype of this aspect of the technology during 2001. On completion of the exercise they will be in a better position to identify the feasibility of this approach.

5 Benefits to Users

Expected Benefits to End-Users

- 5.1 There are five groups of stakeholders identified for the proposed improvements. Financial benefits are set out in section 9.5 containing the investment appraisal.

Markers

- Simpler types of test answers may be marked by non-teachers with appropriate software support.
- Throughput of marking should be improved. If payment per script remains on the same level as today or is part adjusted to take account of improved productivity, markers will be paid more per hour as a result of increased throughput.
- The use of on-line training (and the development of more material each year) will result in targeted, more convenient training. Training can be taken as and when required.
- Direct data input with software support should remove clerical tasks. This currently accounts for around 10% of marking time and this should be reduced to near zero.

Teachers

- More detailed performance information can be provided to help judge pupils' progress.
- The use of common data standards will reduce the time taken to register pupils for tests.
- Reduce burdens on teachers by requiring less form filling and paperwork.
- Increase confidence in the marking process by increasing the accuracy of the system. This should then result in fewer requests for reviews.
- Provide images of the original scripts on CD-ROMs sent to schools.

Local Education Authorities

- The data collected at a more detailed level should allow LEAs to benchmark school performance and to target resources as necessary to improve performance of the authority as a whole.

Government Departments and their Agencies

- Addresses the aims of the Modernising Government agenda.
- Provide more detailed data for use by government statisticians.
- Reduce the time to perform the marking and data collection cycle.
- Reduce the cost of performing the process by around 10% or £2 million per cycle.
- Provide the capacity for future changes, such as preparing the infrastructure needed for on-line testing.
- Increase transparency between departments, agencies and suppliers through the provision of relevant management information and clearer structures for contracting.

Ofsted

- Ofsted could have access to school performance reports and to pupil performance reports as additional source material for use when conducting inspections of schools.

Consultation

- 5.2 Some users have been consulted before the preparation of the submission, including the DfEE, LEAs and Senior Markers. Support for the proposed project is overwhelmingly positive. Specific requests have been made for the project to focus on delivering a reduction of the amount of data input required by schools, electronic feedback of pupil performance data to schools, improved turnaround times and improved reliability of marking and data capture. All these areas are covered by the submission.

Evidence of Overseas Experience

- 5.3 In New South Wales, Australia, marking of scripts is undertaken centrally. Scripts are marked twice and training and monitoring of the markers' marking is centrally directed. On a like-for-like basis, marking times per question are roughly the same. However, the overall elapsed time is about 1 to 1½ weeks shorter in Australia than in the UK. The additional time in the UK is taken up by scripts being sent to markers from schools and colleges and with markers sending samples of scripts through the post to supervising markers for checking. However, mark processing in NSW is faster due to the immediate collection of mark sheets from markers on site.
- 5.4 In the USA, where marking is undertaken on screen centrally, the time for marking the complete work of a pupil is reduced considerably due to the direct electronic delivery of questions to markers and the supervision of the markers on-line. Mark capture is direct onto the PCs.

6 Estimated Savings

Savings

6.1 The following estimated savings are based on data for England only. If the other regulatory authorities participate as set out in the bid, the economies of scale are increased. Savings from the proposed initiatives break down into a number of categories:

- registration process savings;
- training process savings;
- additional costs incurred for collection, primarily for scanning;
- marking process savings; and
- management efficiency gains.

Calculation of Registration Savings

6.2 The current cost of registration is £3.2 million. This breaks down into an administrative cost of £0.4 million and a schools burden cost of £2.8 million (which covers administrative work undertaken by teachers in schools). The proposed initiative will save by:

- assuming that school records will be held in a school system that supports on-line data exchange (with suitable safeguards for security) and that the burden of form filling will be reduced. The anticipated reduction is around £1 million; and
- assuming that administration time is saved on paper-based tasks, the anticipated reduction is around £200,000.

Savings from Automation of Training

6.3 The current cost of training 11,000 markers is £4.1 million. This breaks down into an administrative and organisation cost of £2.7 million and a cost of £1.4 million for marker time attending the training.

6.4 The proposed web-based training project will move training on-line and will save by eliminating current costs associated with organising training centres, attendance, travel and subsistence, preparation of training materials, and other associated costs. This reduces the costs by around £1.8 million to £2.2 million.

Additional Costs Associated with the Collection Process

6.5 The current process of collecting completed scripts requires schools to collect and sort papers, to send each subject set of scripts to a predetermined marker, and then for the marker (once marking has finished) to send mark sheets to a central address for data entry and return the scripts and another copy of the mark sheets to schools.

6.6 The proposed on-line scanning service will require a bank of high-performance scanners, image processing software and a high volume image database. The costs of providing these resources will be charged to the process as an amortised cost by a service provider.

6.7 The current cost of collection is £4.9 million, which consists of £1.7 million for the collection process and £3.2 million for school burden costs.

6.8 The projected future costs of scanning and collection are £3.7 million. This breaks down into a schools burden of £1.4 million and costs of £1.1 million for scanning and around £1.2 million allowed for the rental of hardware and software. This represents a decrease of £1.2 million in costs. However, the process cost has risen by £0.9 million, and burden costs fall by £1.8 million mainly due to the elimination of the need to sort papers alphabetically and to mail packs of scripts to different addresses.

Savings from the Marking Process

- 6.9 The current cost of marking is £10.8 million of which the main component is the amount paid as a fee per script to markers.
- 6.10 The main area for saving on marking is in the amount paid to mark a script. The existing process has an average script marking cost of £2.40 which includes an allowance of 25p for clerical checking. If we assume this will be saved due to automation of the clerical check the cost per script falls to £2.15.
- 6.11 Further costs may be saved if use is made of 'lower skilled' markers for data entry of single word answers. These are not costed as savings and further details of the potential for savings here will come out of the proposed pilot for on-line testing. The future process costs are calculated as £10.3 million, which represents a saving of £0.5 million.

Savings from the Project Management Process

- 6.12 The current management approach to subcontracting the marking and data collection processes will be changed to open out the contracts to more competition and to define the work more in terms of outcomes. This will involve using more service level agreements, potentially more suppliers in well defined areas of support, and an attempt to reduce the complexity of individual work packages reducing the costs correspondingly.
- 6.13 It is assumed that with a tightening of control and the introduction of more competition it will be possible to reduce current costs by an additional factor of 1% per annum over a three year period. With total current costs of around £26 million (of which £7.4 million are burden costs on schools) this translates into sustainable savings of £0.19 million in year 1, £0.38 million in year 2 and £0.57 million in years 3 to 10.

7 Additionality Test

- 7.1 The details of the partner bodies to this submission are provided in the introduction. Each partner body is committed to supporting the project by making available staff, resources and time to co-ordinate activities across the UK.
- 7.2 QCA has already begun a study of how the key stages 2 and 3 test marking and data capture processes could be redesigned and improved, CCEA has also carried out some work in this area. The scale of the marking exercises in Northern Ireland and Wales for statutory tests is very much smaller than for England (a total of 60,000 pupils compared with 600,000 in England).
- 7.3 The level of the investment required by of the regulatory authorities, in Northern Ireland, Wales and by SQA in Scotland, would be very high compared with the annual running costs for the statutory tests. Only QCA would probably be in a position to make a sustainable case for a reasonable internal rate of return. For the other regulatory authorities it would be very much harder to do so, given the levels of funding which each receives from their respective administrations. Combining the efforts of the four bodies strengthens the financial case as well as enabling the benefits of the large-scale process to be made available on a smaller scale in Northern Ireland, Scotland and Wales. In essence, it is unlikely that the three smaller bodies would contemplate changing existing process which work, albeit at a level of efficiency which reflects the current technology employed, for as yet unproven technology where the investment costs would be proportionately very much higher. In addition, the original QCA plans had anticipated developments in this area but to a very much longer timescale.

8 Accountability and Audit

8.1 QCA has adopted PRINCE2 for use by the QCA team to manage the external marking and data collection process. This method is recommended as best practice for project management by the CCTA. PRINCE2 enforces many forms of control over a project. It includes the following:

- Project Organisation – with a strong focus on accountability; and
- Business Case – used as the basis to authorise spend.

8.2 The main accountable officer will be the Chief Executive David Hargreaves of QCA, who will perform the role of Project Executive of the Project Board. He will be the Senior Responsible Officer. Audit of how ISB money has been spent will be performed by QCA's internal audit and the partner's internal auditors.

9 Project Cycle Management

Economic Appraisal

9.1 In this section seven options are analysed. Sensitivity analyses have been carried out to show how changes in the scale of implementation will affect the net present values.

Costs

9.2 Costs have been estimated and are presented under the analysis section. For summary purposes, the following cost profile is expected:

Year	Current Costs	Capital Costs	Ongoing Support Costs
1	£1,404,000	-	-
2	£1,330,000	-	£1,127,000
3	£1,059,000	-	£1,579,000
4	£275,000	-	£1,629,000
5	£185,000	-	£1,639,000
6-10	£0	-	£1,639,000

9.3 These costs have been calculated using information available to QCA at the present time. More accurate costings are expected to come out of work planned to prototype the on-line marking process.

Note:

- It has been assumed that it will be possible to procure a service from an application service provider (ASP) where the selected software and hardware can be 'rented' on a transaction or annual subscription basis rather than purchased outright.
- It has been assumed that the current pilot work on on-line marking will be reusable for building a production system and that the pilot successfully demonstrates the technology is suitable for use in a production environment.
- It is assumed that the cost of image processing software will be around £2m and that hardware costs will be around £0.5m for a 1.5TB image jukebox and database/web server.

9.4 A discussion of sensitivities is given in the analysis below.

Benefits

9.5 The following benefits are expected from each project:

Project	Source of Benefit	Amount	Year of Realisation
On-line and Web-based Marking	<ul style="list-style-type: none"> Reduction of payment for scripts – assume 25p per script less due to automatic addition of marks. Scanning costs at 1p per sheet plus collection and processing costs result in additional costs of £900k per year. 	<p>£500k</p> <p>Additional cost of £900k for scanning collected images.</p> <p>Burden costs for collection are £1.8m less due to less administration required from schools.</p>	<p>Standard on-line marking will be delivered in year 2 with no net benefit.</p> <p>The £500k benefit will start in year 4 when web-based marking will be possible.</p> <p>The £900k extra cost will start from year 2 when scanning will be implemented.</p>
Web-based Training	<ul style="list-style-type: none"> Elimination of travel and attendance fees. Elimination of admin/organising fees. 	£1.8m	<p>Year 2 – half realised</p> <p>Year 3 – fully realised</p>
Personalised Scripts	<ul style="list-style-type: none"> Less error rate for scanning. Less costs chasing ‘lost’ scripts. 	immaterial.	Year 3
Change Management	<ul style="list-style-type: none"> Smoother implementation of changes. Avoid costly problems associated with loss of goodwill from stakeholders. 	£0k	-
Management Information	<ul style="list-style-type: none"> Better control over more complex contract set up. Able to run with increased competition. 	£0k	Year 3
Interface to IMS	<ul style="list-style-type: none"> Elimination of most registration costs – keying, postage, form filling. 	£200k process saving £1 million burden cost saving	Year 5
Develop Management Framework	<ul style="list-style-type: none"> Ability to squeeze more value from introducing greater competition. Assumes delivery of 1.5% annual improvement for 3 years. If current total process costs are £19m (with a burden cost of £7.4m) this results in an approximate saving of £190k per year for each year. 	<p>£190k year 2</p> <p>£280k year 3</p> <p>£570k year 4 and onwards</p>	Year 2

Risks

- 9.6 A full discussion of risks is made in Appendix 1. The risk assignment will generally follow these principles and these have been used to decide how the project will be approached.
- **Costs for software development.** For innovative developments risk will be shared for the definition of requirements and the development of a prototype to prove technology. Once technologies are proven, risk is shared in the definition of a requirement specification, followed by the risk of overspend on development cost being passed to the supplier by enforcing a fixed price development contract.
 - **Ownership of equipment.** To be provided and owned by third parties. For example, scanners will be provided by a supplier on a per sheet cost, where the operator is responsible for the balance required between servicing the equipment, speed of operation, and resolving scanning errors.
 - **Hosting of production software and hardware.** To be provided by an ASP where the intention is to pay an annual service charge or a per transaction charge to cover the cost of provision plus a profit margin over an agreed operating period. This reduces the risk of the regulatory authorities not finding adequately skilled staff, and reduces costs to a predictable amount.
 - **Technical feasibility of solution.** It is planned to perform a prototype of the solution so that the feasibility and costs can be demonstrated in a practical environment. Once confidence has been generated that the solution is feasible, affordable and practical, risk can be transferred to the development supplier.

Uncertainties

- 9.7 At the current stage of development, the project has a number of uncertainties that need to be managed and controlled as part of the project management process.
- **The feasibility and cost of providing on-line marking.** This is well recognised as part of the business case for the project and will be revisited each time further funds are required to progress the project. A pilot is planned to demonstrate the feasibility of the approach in this academic year (2000-2001).
 - **The feasibility of scanning a high volume of paper.** This is becoming easier with the current generation of scanners – with double-sided scanning and a throughput measured in pages per second. With millions of pages to scan the throughput must be demonstrated and capacity assessed. As with the previous point the business case will recognise this uncertainty.
 - **The acceptability of the approach for stakeholders.** Some consultation has been made on the approach and has been generally well received, with interest. It should be noted however that marking is seen as an additional source of income for markers, and that simpler tests such as key stage 2 mathematics is both very popular for marking as well as being easiest to automate. As with the previous points the business case will recognise this uncertainty. The project plans a change management exercise to help with this issue.

Analysis

- 9.8 This analysis compares seven different options for this project. Each option is discussed in terms of its approach, if appropriate a calculation of NPV is made, and specific points are raised if relevant.

Option 1 - Do Nothing

- 9.9 This option will not be evaluated in full as in the medium to long term it is not a valid course of action. The 'Do Nothing' option will not address the Modernising Government agenda; be able to support additional demands on the process. It will leave the regulatory authorities exposed to a limited (and decreasing) set of

suppliers who, because of lack of competition, lack the incentive to propose radical improvements in service and cost.

9.10 The current costs of the process have been calculated and allocated across the various sub-processes within the marking and data collection process. These are used as a baseline for the calculation of benefits set out in the other options.

Option 2 - All Projects

9.11 This assumes that all of the proposed projects will be implemented and that the benefits and costs are as set out in the earlier sections of this appraisal. A discount factor of 6% is used to calculate the NPV for implementing all projects, over a 10 year period, as shown in the table below:

Year	Investment Cost (A)	Savings (B)	Net Flow (B-A)
1	£1,404,000	£0	£(1,404,000)
2	£1,340,000	£190,000	£(1,150,000)
3	£1,059,000	£1,180,000	£121,000
4	£,275,000	£1,970,000	£1,695,000
5	£185,000	£2,170,000	£1,985,000
6	£0	£2,170,000	£2,170,000
7	£0	£2,170,000	£2,170,000
8	£0	£2,170,000	£2,170,000
9	£0	£2,170,000	£2,170,000
10	£0	£2,170,000	£2,170,000
		NPV	£7,410,000

9.12 The NPV is £7.41 million. The discount factor required to break even (IRR) is 40%. The total outlay required for the full set of projects is £4,263,000.

9.13 The option assumes that hardware and software can be provided by a third party ASP that effectively purchases the required hardware and software and rents it back on a per transaction or subscription basis. Not all software vendors allow their software to be used in this way. However, it is becoming a more common form of provision and attractive as it provides the required applications for a single fee including all aspects of administration and necessary upgrades.

Option 3 – Partial Set of Projects

9.14 If a partial set of projects were to be implemented a different cost/benefit profile would be realised; for example, if the following projects are adopted:

- on-line and web-based marking;
- on-line web-based training;
- change management; and
- develop overall management framework.

9.15 This gives the following calculation for NPV:

Year	Investment Cost (A)	Savings (B)	Net Flow (B-A)
1	£1,398,000	£0	£(1,398,000)
2	£623,000	£190,000	£(433,000)
3	£1,053,000	1,180,000	£(673,000)
4	£185,000	£1,970,000	£895,000
5	£185,000	£1,970,000	£1,785,000

Year	Investment Cost (A)	Savings (B)	Net Flow (B-A)
6	£0	£1,970,000	£1,970,000
7	£0	£1,970,000	£1,970,000
8	£0	£1,970,000	£1,970,000
9	£0	£1,970,000	£1,970,000
10	£0	£1,970,000	£1,970,000
		NPV	£7,351,000

9.16 The NPV for the subset of the projects is £7.35m as compared with a NPV of £7.41m for the full set of projects. The total outlay required for the subset of projects is £3,444,000.

Option 4 – Delayed Realisation of Benefits

9.17 This scenario recognises that benefits may not come out of the process as fast as anticipated and performs a sensitivity analysis to show the impact if benefits are realised one year later than set out in the standard model in option 2. This gives the following NPV:

Year	Investment Cost (A)	Savings (B)	Net Flow (B-A)
1	£1,404,000	£0	£(1,404,000)
2	£1,340,000	£0	£(1,340,000)
3	£1,059,000	£190,000	£(869,000)
4	£275,000	£1,180,000	£905,000
5	£185,000	£1,970,000	£1,785,000
6	£0	£2,170,000	£2,170,000
7	£0	£2,170,000	£2,170,000
8	£0	£2,170,000	£2,170,000
9	£0	£2,170,000	£2,170,000
10	£0	£2,170,000	£2,170,000
		NPV	£5,634,000

9.18 This shows that even if benefits were to be delayed, the project will have a positive NPV over a 10-year period. In practice we could expect a delay in benefits if a solution were not implemented in full over one year. For example, on-line marking may be rolled out with caution to a limited scope before it is implemented in full.

Option 5 – Partial Benefits

9.19 This scenario recognises that not all benefits may be achieved and performs a sensitivity analysis to show the impact if only 50% of benefits are realised. This gives the following NPV:

Year	Investment Cost (A)	Savings (B)	Net Flow (B-A)
1	£1,404,000	£0	£(1,404,000)
2	£1,330,000	£95,000	£1,245,000
3	£1,059,000	£590,000	£469,000
4	£275,000	£985,000	£710,000
5	£185,000	£1,085,000	£900,000
6	£0	£1,085,000	£1,085,000
7	£0	£1,085,000	£1,085,000
8	£0	£1,085,000	£1,085,000
9	£0	£1,085,000	£1,085,000
10	£0	£1,085,000	£1,085,000
		NPV	£1,823,000

9.20 This shows that the proposed programme of work is still viable in terms of pure savings achieved if only half of the benefits were realised.

9.21 A calculation has been made to show at what level of partial benefit the NPV becomes negative. This is 40%. Thus as long as the project can deliver 40% of the benefits planned within the costs set out, the project will be viable.

Option 6 – Software and Hardware are Purchased

9.22 This scenario assumes that the regulatory authorities will purchase the hardware and software for the on-line training solution.

9.23 This raises immediate difficulties in the investment costs required as there is a significant increase in the amount of funds needed in years 2 and 3, with a corresponding increase in savings over later years as rental costs are excluded from the cost structure.

9.24 For this option, purchasing will increase spend in year 2 by £2,850k for software, and £500k for hardware or an additional total of £3,350k. An additional cost of £500k is set for year 7 to replace hardware purchased in year 2. This will reduce the cost of support by £770k per year from year 3. This gives the following profile:

Year	Investment Cost (A)	Savings (B)	Net Flow (B-A)
1	£1,404,000	£0	£(1,404,000)
2	£4,690,000	£767,500	£(3,922,500)
3	£1,059,000	£1,950,000	£891,000
4	£275,000	£2,740,000	£2,465,000
5	£185,000	£2,940,000	£2,755,000
6	£0	£2,940,000	£2,940,000
7	£500,000	£2,940,000	£2,440,000
8	£0	£2,940,000	£2,940,000
9	£0	£2,940,000	£2,940,000
10	£0	£2,940,000	£2,940,000
		NPV	£8,865,000

9.25 The funds needed for year 2 cannot be provided under current plans. The additional £1.4 million of NPV gained for this option needs to be assessed against the risks of the regulatory authorities owning the system and being responsible for its upkeep. If staff of appropriate calibre cannot be recruited (due to salary limitations) then a risk of system failure and potential data loss more than offsets the additional NPV gain.

Option 7 – Sensitivity Analysis – Cost of Scanning

9.26 This assumes that the cost of scanning increases by 1p to 2p per sheet. The additional cost associated with this increase is approximately £1 million. A discount factor of 6% is used to calculate the NPV of implementing all projects, over a 10 year period, as shown below:

Year	Investment Cost (A)	Savings (B)	Additional Cost (C)	Net Flow (B-A-C)
1	£1,404,000	£0	£0	£(1,404,000)
2	£1,340,000	£190,000	£1,000,000	£(2,150,000)
3	£1,059,000	£1,180,000	£1,000,000	£(879,000)
4	£275,000	£1,970,000	£1,000,000	£695,000
5	£185,000	£2,170,000	£1,000,000	£985,000
6	£0	£2,170,000	£1,000,000	£1,170,000
7	£0	£2,170,000	£1,000,000	£1,170,000
8	£0	£2,170,000	£1,000,000	£1,170,000

Year	Investment Cost (A)	Savings (B)	Additional Cost (C)	Net Flow (B-A-C)
9	£0	£2,170,000	£1,000,000	£1,170,000
10	£0	£2,170,000	£1,000,000	£1,170,000
		NPV		£993,000

9.27 The NPV is reduced dramatically £0.99 million. Options for halving benefits and delaying benefits result in negative NPVs of -£0.78 million and -£4.6 million respectively. This suggests that a doubling of the cost for scanning may result in a positive NPV only if the expected benefits can be achieved almost fully. This must be recognised as a programme risk and addressed in the business case.

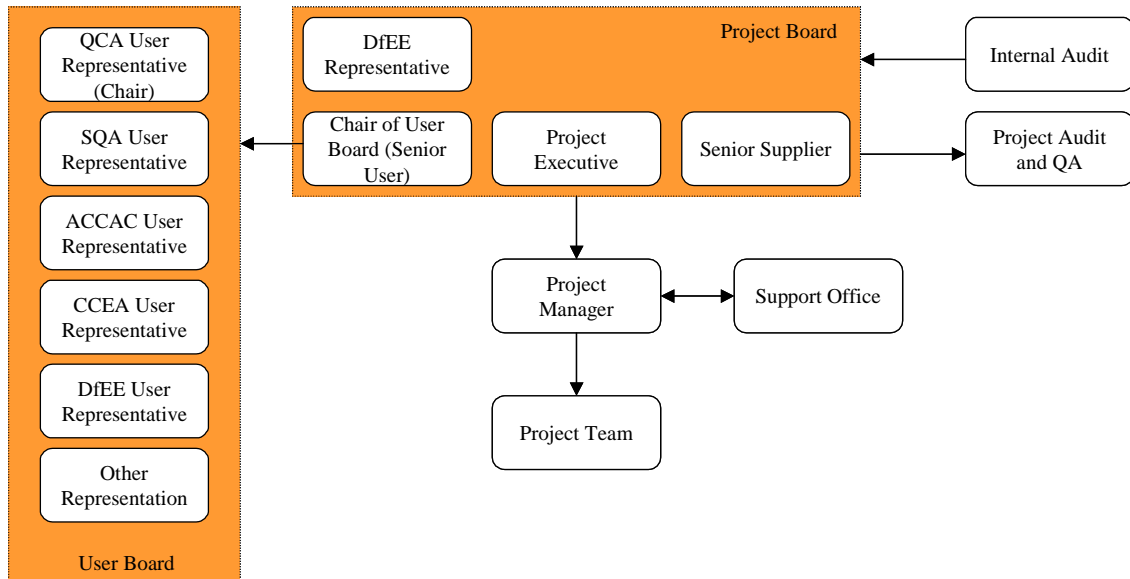
Results of Appraisal

9.28 The appraisal shows that the project has a good NPV with the standard scenario option and is viable if benefits are halved or delayed. The project is particularly vulnerable to the cost of scanning. With approximately 100 million sheets to scan a small rise in cost has a disproportionate effect on the overall cost of the project.

9.29 This result supports the case to proceed with the project, with sensitivities to be added to the project’s business case as assumptions and to the project’s risk register.

9.30 The appraisal will be repeated once more accurate figures are available as a result of the planned pilot into the scanning and marking process.

9.31 The project organisation for the process improvement project is shown in the diagram below:



9.32 This shows a project board, consisting of four people, a supplementary user board consisting of interested bodies, including the partners for the project, a project manager supported by a project support office, a project team(s), internal audit and project Quality Assurance (QA):

- the project executive will be David Hargreaves who is the Chief Executive of QCA and the Chief Accounting Officer;
- a user board is set up to provide a forum for representing user and partner views. This mechanism is put in place to ensure the project board complement is of a manageable size to run project board meetings;

- user representation on the project board will be from the user board chair (initially from QCA) and a representative from DfEE; and
- the project manager will be Graham Hudson, QCA's Principal Manager of External Marketing and National Data Collection, who has held responsibility for the successful management of the process for the previous year and who has previous experience of managing similar contracts for a national awarding body.

9.33 The project Board will give project direction monitoring benefits realised and will be reported to be the project manager. The Project Board supports the Executive in realising the business case.

Business Case and Project Stages

9.34 PRINCE2 requires a Business Case to be prepared to document the reason for performing a project. The business case sets out the business improvements expected as a result of performing the project, provide an indication of the investment required, identify any cost savings and benefits, identify how benefits should be measured, and identify risks associated with the project.

9.35 The business case is owned by the project executive. The project executive, together with the project board is responsible for delivery of the benefits set out in the business case. For the proposed project, a business case will be prepared, based largely on the contents of this bid.

9.36 To further control the project the plan is divided into two or more management stages. Each management stage represents a tranche of work at the end of which the project board will be asked to approve the results of the previous stage and to approve commitment of resources and funds for the following stage.

Evaluation

9.37 The implementation of the project will adhere to the PRINCE2 methodology. This will ensure the programme of projects is monitored closely so as to ensure successful implementation. At each milestone throughout the planned implementation the Project Board will be provided with interim assessments from which to evaluate the outcome of that stage of work against that set out in the business case. A further full evaluation will be carried out following completion of the programme of projects and a report documenting the lessons learnt will be disseminated to the parties involved and more widely where appropriate.

9.38 To ensure the benefits set out in the programme are delivered, these will be assessed against the criteria devised to measure success. This will consider the effects on both existing performance measures and yet to be devised measures which reflect the changes resulting from the programme. These will draw on ensuring evaluation against the criteria in the Treasury's Green Book.

Risk Assessment

Risk	Probability	Impact	Comment
Software development late	Medium	High	Reduce the risk by: <ul style="list-style-type: none"> • taking a modularised approach, using proven technology where possible; • using reputable firms with a proven track record to prime the project; • implementing strong controls and risk management techniques to flag any early problems of feasibility.
Actual costs greater than estimated costs	Medium	Medium	Reduce the risk by: <ul style="list-style-type: none"> • implementing PRINCE2 (staged approach which strongly links the business case to costs as the project evolves); • preparing a prototype for on-line marking to identify costs and feasibility; • ensuring a fixed priced procurement where possible.
Infrastructure more complex than anticipated	Medium	Medium	Reduce the risk by: <ul style="list-style-type: none"> • implementing PRINCE2 (staged approach); • Considering reduction in complexity of functionality and scope of the system.
Marking takes longer than anticipated	Medium	Medium	Reduce the risk by: <ul style="list-style-type: none"> • preparing a prototype to test system; • seeking modest productivity improvements; • ensuring sufficient training for markers.
Volume of scanning too high to physically cope with	High	Medium	Reduce the risk by: <ul style="list-style-type: none"> • preparing a prototype to test system; • Researching the market to be aware of latest (budget to attend supplier demos and conferences)
Implementation of change programme managed badly	Medium	High	Reduce the risk by: <ul style="list-style-type: none"> • Implementing PRINCE2, ensuring board level involvement and direction; • Ensuring consultation with users.
Lack of “interoperability” between all users	Low	High	Reduce the risk by: <ul style="list-style-type: none"> • ensuring consultation / communications with users; • ensuring appropriate training for users.
System grows beyond expectations	Medium	Medium	Reduce the risk by: <ul style="list-style-type: none"> • Implementing PRINCE2, monitoring progress by milestones.
Lack of inadequate induction and training	Medium	Medium	Reduce the risk by: <ul style="list-style-type: none"> • Undertaking a training needs analysis and consultation process with users.
Increased burdens on schools	Medium	Medium	Reduce the risk by: <ul style="list-style-type: none"> • Preparing a prototype to test the process; • Monitoring progress using PRINCE2.