

EUNIS Elite Award Submission Oxford Brookes University

An MIS Intranet based on a Long-term MIS Strategy

Introduction

This submission presents a particular MIS Intranet application and also the strategic approach of which the application is a product. It provides as an example of a successful application development resulting from a successful approach to strategic planning for MIS in a University. Furthermore, it illustrates how MIS may engage with the wider strategic development of a University.

The application is called "PIP", the meaning of which is explained below. This application was the winner of the UK Universities and Colleges Information Systems Association (UCISA) 1999 Web Award for Management Information/Business Systems. More information is available on the UCISA web site at <http://www.ucisa.ac.uk/docs/pr/pr10.htm>

However, the UCISA Award took little note of the wider strategic context against which this application was developed and the strategic influence which it has in turn, had upon Oxford Brookes University. These wider issues are presented here for the first time.

The Strategic Environment

Until 1989, Oxford Brookes University had little MIS capability. At that time UK Government policy resulted in changes to the status of the institution which in turn, led to the establishment of a small MIS unit of around six staff. MIS now has 11 staff engaged in the development or support of corporate systems.

This expansion reflects an increase in the importance of MIS to the University and is in part a consequence of the particular approach to MIS strategic planning presented here. More precisely it is a result of the success of the strategy in delivering working systems. It is this which gives the University the confidence to invest in MIS.

During 1990 a formal MIS Information Strategy was developed. The method used was heavily influenced by the Entity Relationship Modelling (ERM) techniques associated with relational database technology. Utilising this model based approach an architecture for the University's administrative systems was agreed. Within this architecture detailed data models were prepared in order to understand the needs of specific application areas such as course and student records, personnel, student accommodation administration and student fees administration. These were complemented by a relatively simple analysis of business processes.

Several development initiatives were formulated on the basis of this information model. The model, now considerably evolved, continues to provide the foundation for MIS systems at Oxford Brookes University.

The most substantial project to arise from the 1990 MIS Strategy was a new Course and Student Management System (CSMS). Brookes has a distinctive and highly evolved modular

undergraduate programme and the decision was taken to develop the system in house since available packaged solutions were inappropriate.

It would be wrong to give the impression that this development was easy or immediately successful. However, by late 1995 the new CSMS had begun to earn the respect of senior management, administrative and academic staff. This, along with similar success in other application areas allowed senior management and heads of administrative departments to formulate further development plans with some confidence.

It is important to appreciate that the models on which these initial developments were based were designed to anticipate longer term needs. The intention was to get the underlying model right, especially the data model, and build on this.

However strategy and models are not enough. Technical staff must have suitable skills and tools to realise solutions. Computer hardware and software must be capable of delivering these as dependable services. From the outset the need to integrate these elements with the model based MIS Strategy was a key consideration. Oracle development tools, including Computer Aided System Engineering (CASE) were adopted and staff were trained in these. Similarly Oracle databases were used to deliver the applications systems to end-users. Sometimes these were software packages, but often bespoke in house development was favoured as a solution to the particular needs of the University. This use of relational development and delivery tools was in full accord with the model based strategy.

The very deliberate approach to MIS Strategy which is outlined above is relevant to this submission in two senses.

- Firstly, it provided the capability to develop the PIP application which is discussed in the next section.
- Secondly it established MIS as a component in the wider Information Strategy of the University. This was to become important later as the synergy between MIS Strategy and that for learning information was recognized.

The PIP Project: Immediate Goals

We now turn to the specific project which is at the heart of this submission. By 1995 the strategic approach described in the previous section had become accepted in the University. Confidence in the technology and skills available to MIS encouraged key decision makers to think creatively. One result of this is the project which is described here. This is now known as the PIP project, which stands for "Personal Information Pages".

The project was initiated in response to several requirements.

- A more user-friendly user interface for our MIS systems was sought. Since these were largely Oracle based they had originally been implemented as character mode screen forms and reports. For some time Oracle had been advocating the client-server paradigm, but MIS had resisted this on the grounds that it was difficult to deploy and support in a heterogeneous Microsoft Windows environment such as that at Brookes. The advent of web clients such as Netscape offered a new standard interface which was easy to deploy. Key senior managers supported the conclusion reached by MIS, that a web client interface should be progressively introduced for our MIS systems.

- The decision to introduce web client interfaces for our MIS systems was also seen to offer important advantages in terms of administrative efficiency. The sophisticated system which had been developed for the management of course and student information (CSMS) had met a large range of requirements. But now that it had been operational for a few years, more radical ideas began to develop among user management. In particular the prospect of reducing paper-based administration by allowing students "self-service" access to administrative processes. This was seen as a possible solution to the unfortunate fact that while national policy promoted expansion of the University, resources to cope with the increased administration which resulted from this policy were highly constrained and even reducing.
- A further benefit was the prospect of increasing the quality of administrative processes. The University had long suffered from the problem that multiple versions of course definitions were often in existence, each kept by a different party. For instance, the officially approved course definition was kept by the Academic Registrar's Department. The academic department responsible for delivering the course naturally kept its own working copy of the same information and last, but not least, a version of the information was entered into the administrative computer system (CSMS) to support the processing of student records. There was ample opportunity for inconsistency among these various copies of course definitions, for instance through transcription errors or failures in change control. The consequence of this could be confusion for staff and students about what exactly were the requirements for completing a particular course of study. The advent of web based interfaces to the CSMS system, presented the opportunity of publishing the data held in the system in an easily accessible and easily understood manner. Increasing the visibility of the information in this way was seen as a means of improving the quality of the information in the University and hence the quality of the administrative processes which depended on it.
- A final contributory requirement arose from an internal study of the demands on Personal Tutors. These are the academic staff responsible for providing individual advice and support to students. There had been dissatisfaction for some time among Personal Tutors due to increasing workloads and a feeling that much of the time they had to devote to students was being soaked up by a routine administration. What was needed was a way to allow Personal Tutors to spend more "quality time" with their students, taking a more in-depth look at their needs rather than just helping them to fill in administrative forms.

These requirements came together during 1995 in a project to adapt some existing CSMS facilities for use via a web browser. The intention was to allow a student to view and make changes to their course of study using a normal web browser such as Netscape. This could usefully reduce paper based administration. However, the same facility would be available to personal tutors allowing them to deal with course administration issues in a more streamlined manner or even removing the need to provide students with purely administrative advice regarding their programme of study and how to make changes to it.

By way of explanation, it should be noted that the type of modular undergraduate degree course operated at Oxford Brookes University allows students to refine and change their programme of study as they progress. The programme of study is not fixed when the student enters University. This flexibility, while educationally advantageous for the student, is administratively demanding, leading to the need for the application described above.

The PIP Project: Implementation Environment & Constraints

While there was consensus among senior management, administrative staff and MIS staff regarding the goals of the project, it was also clear that the amount of time available from development staff would be limited. The many other demands for MIS resources meant that this rather avant-garde project could receive only marginal attention.

The pressure was increased substantially when the Vice Chancellor, who had attended a demonstration of a very early prototype, made it clear that he would like to see a substantially complete demonstration of the system as part of a programme of events to raise awareness of information technology generally in the University. This set a deadline of June 1996, allowing no more than five months to develop a completed application.

The technology platform also presented some problems. At this time, software tools for creating web based applications to run against Oracle were in the early stages of development. The tools were very primitive with no training and little support available. However, this did mean that the cost was low, which was fortunate as there was no specific budgetary allowance for this project. The application would have to run on existing hardware using, for the most part, existing software resources.

Even so the June 1996 deadline was achieved. Public demonstrations were arranged for the staff and students of the University. The response was very positive, generating early and substantial support for the role of web based MIS systems in the University.

Since 1996 the project has been developed further, coordinated by a small working group. This includes the three MIS development staff who were undertook the pioneering work, plus key staff from the Academic Registrar's Department (responsible for student and course records in the University) and crucially, a small number of academic staff who put themselves forward to assist in developing the application and its prototype deployment in their respective departments. To these must be added the time and attention of a considerable number of other staff across the University who have assisted in one way or another during the last four years. Even so, the development team numbered no more than four individuals in the early stages, more recently rising to approximately 10 persons (including administrative and academic representation). In all cases these people devoted no more than a small fraction of their time to the project.

Results of the PIP Project: The Operational System

The best way to see the practical results of the PIP project is to visit the web site at

http://www.csms.brookes.ac.uk:8889/csms/owa/wprin_menu.main

This is also available from the Brookes homepage at www.brookes.ac.uk by selecting "Online Information for Staff and Students".

Some of the facilities are open to access from the Internet. Others require authentication and to illustrate these a guest account is available. Please note that this guest account is rather primitive because the limited development resources make it unreasonable to put substantial effort into a sophisticated demonstration facility.

So far the following facilities have been implemented as part of this development.

Firstly there are a several services which are publicly available to the Internet as well as students and staff of the University. These include the following.

- Course, Field of Study and Module Searching. These are all interfaces to the Modular Programme Database which also visible on the University web site from other links. These services are based on dynamically generated html from the CSMS database via the Oracle Web Server.
- There are also facilities to improve the quality and availability of room booking information within the University. This is specifically for certain academic schools who operate in such a way as to gain benefit from it. Not all schools do this.

In addition to the Internet accessible facilities note above, there are other key services which require authentication. These include information which is specific to individuals and the privacy of this information has been an important consideration from the start of the project. A username and password are required to access this part of the application. In addition, the application implements the Secure Sockets Layer (SSL) to encrypt data transmitted between the web browser and the host. This is necessary to allow transmission of private data via the Internet.

Successfully implementing SSL was an important milestone in the project and was achieved as part of the initial demonstration project. Without it, the geographical reach of the project would have been limited to secure internal networks within the University. However it has raised one issue which remains difficult to solve: how to distribute usernames and passwords to students in an efficient but secure manner. The University administration is gradually evolving solutions to this issue.

The secure, authenticated facilities implemented so far include the following.

- Student Personal Details: this consists of basic student record information including name, address and previous academic record prior to joining the University. At present this information is read-only and provides a visible quality check for the student. Errors may be corrected via normal paper based administrative processes. In due course, this information will be updateable by the student, but this is a big step to take and the confidence of University administrators and students must develop further before this can be implemented.
- View/Change Programme of Study: this is the most sophisticated part of the system. It allows the student to view the details of the course they are studying including the modules that they have selected and the marks they have achieved. It also allows on-line updating of this programme of study so that module selections can be adjusted as the student's academic career develops. When a student makes a change to the programme of study this is automatically validated against a set of rules held within the system and a confirmation or rejection message is displayed immediately to the student.
- View Timetable: this is a natural extension of the facility to view the programme of study, integrating course information with room allocation data. The integrated design of the underlying CSMS system makes this relatively straightforward to do. Please note that the primitive nature of the demonstration "guest account" means that this timetable is often empty of detail, which is obviously not the case for real students.

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The rules of Modular Course at Brookes are flexible, complex and extensive making the course validation process a demanding technical challenge. The program is written in C and runs as a background process on the host. A very important point is that this process was not written explicitly for the web-based PIP project. It existed before and is part of the original CSMS system of which PIP is an extension. The capability to automatically validate complex course structure was a key part of the original design, anticipating the need and opportunity to automate, streamline and devolve this process. This is an excellent example of the benefits of a model based strategy. It underlines the fact that the PIP development is not a "one-off" opportunistic development, but a natural evolution of a thoroughly designed, integrated corporate management information system.

The present status of the PIP application is that it is available to all students of the University, but only students in two Academic Schools (The School of Business and School of Mathematical Sciences) have the full service including the on-line update to a programme of study. This is primarily because the academic and administrative consequences of releasing this to students need careful management. Other Schools will gradually join in the scheme.

Results of the PIP Project: Strategic Consequences

The preceding section describes the results of the PIP project in a relatively detailed, technical sense. Here we look at the wider administrative and strategic impact.

The first thing to note is that the introduction of a web based interface to CSMS has been successful and is widely regarded as an important improvement and in the ease with which academic staff can gain access to information about their students. Web based interfaces are now accepted as the new standard for administrative information systems in the University

The project has also been successful in improving the support available to Personal Tutors and other academic staff. A significant number now use the PIP application to help them examine and solve study programme issues relating to the their students.

The project has been less successful in delivering increased administrative efficiency. In this respect, it is fairly clear that the obstructions are not technical. Rather, it takes time for administrators, academic staff and their clients (students) to become familiar and comfortable with this radically new way of doing of things. Both procedures and attitudes must evolve. It would of course, be possible to force the pace of change much more than Brookes has done. A well resourced University wide business process re-engineering project would deliver greater change in shorter time scales. However, a gradual rather than revolutionary approach is favored at Brookes at present.

Even so, important administrative foundations have been established to support a move to an increasing number of devolved web-based procedures. The level of awareness and support for this line of development is satisfyingly high among senior managers, administrators, academic staff and students. Adoption of existing PIP facilities is proceeding and plans and preparations for further applications are in hand.

Importantly, the project has yielded improvements in the quality of course definition data within the University. As intended, the PIP system has given a higher level of visibility to the

course definition as recorded in the central administrative system (CSMS). Mismatches between this and other documentation are more likely to be detected and corrected. In some cases, course definitions which had become over elaborate have been reviewed and simplified to allow more effective use of the PIP system. Such initiatives have been wholly driven by Academic Schools. This is not a case of administrative demands limiting academic requirements. It reflects a desire on behalf of the Academic Schools to optimise the efficiency and quality of their courses.

The most significant strategic consequence of the PIP project has been a recognition that administrative information and learning information must be integrated at the point of delivery. Very early in the development of the project, senior managers and academic staff noted that if the University was to provide students with a range of administrative information relating to their course via a web browser, it would be quite natural to link web-based learning information to the relevant course information.

This coincided with a major initiative to develop a Resource Based Learning (RBL) Strategy for the University. RBL is the term preferred at Brookes for learning systems emphasizing printed and electronic materials and other media. Leading figures in the development of this RBL Strategy were influenced by the PIP project and began to focus on web-based delivery of information as the key to RBL.

A further strategic synergy emerged. The Higher Education Funding Council for England had promoted the need for Information Strategy in Universities. Detailed advice was issued to Universities and some resemblance to the original 1991 MIS Information Strategy was noted at a senior level in Brookes. This was the very same strategic plan which had eventually given rise to the PIP project. The result was the recognition of strong synergy between MIS strategy, University Information Strategy and Resource Based Learning Strategy.

It was decided to coordinated work on RBL Strategy and Information Strategy with MIS Strategy. Responsibility to lead this was allocated to the Dean of Learning and Teaching resulting in a set of strategic policies, projects and a steering committee structure which is now working to realise the benefits of the world-wide "electronic learning" revolution for Brookes.

The Future

At a detailed technical level, the PIP project will benefit from new and more powerful server systems which are currently being installed. Previous equipment had reached the end of its useful life and was scheduled for replacement some time ago.

Complementing this improved hardware platform, Oracle and other software vendors are introducing much improved software support for web-based applications, both in terms of development tools and delivery capability. New, more sophisticated and capable Oracle Web Server technology (now know as Oracle Application Server) will make it easier to deploy more services via a web browser. Some of the existing PIP software will be reengineered to exploit the improved transaction processing facilities now present.

The continuing evolution of the administrative environment in Brookes so as to exploit and develop web-based services is well advanced as noted in the previous section. In parallel with this, the University is making process with its RBL and Information Strategies, which are

steering the introduction of web-based learning technology. A substantial investment in a product such as Lotus Learning Space is likely and this will be integrated with the Brookes specific administrative framework provided by the PIP project.

Conclusions

There follows a list of conclusions which may be drawn from this submission. Many of these are offered with the intention that they may be of value to other institutions seeking to learn from the experience at Brookes which is recounted here.

- This submission provides an example of MIS success founded on a model-based approach. In this case, a model-based approach was used as part of the initial strategic analysis and direction: as a strategic planning tool.
- It is important for the strategic model to flow down into the system development and programming skills available to the institution and the need to develop these as an integrated component of a model-based ethos.
- Similarly, the submission points to the need for development and delivery technology to integrate with and support the overall modelling approach. The roots of relational database technology lie in data modelling techniques and this submission illustrates the proper use of this technology to implement the unique requirements of a particular institution. Too often this formally correct use of relational theory and relational technology is forgotten as relational databases are seen merely as a convenient and standard platform for generic packages.
- In sum, this submission illustrates the practical benefits of a co-ordinated approach to strategic planning technique, system design/programming skills and the underlying development tools and implementation technology. All three elements are essential as is the need for integration and synergy between them. They provide a foundation for a capable MIS function.
- Applying this capability to exploit web interfaces to Oracle systems may have been innovative in 1995, but is hardly so now. Such systems are increasingly common. However this submission does provide an example of a relatively mature attempt at the gradual introduction of web based MIS services to an institution. It also shows that web based MIS systems are indeed popular with users, effective, efficient and capable of delivering sophisticated self-service facilities to students and staff.
- Little that is recorded here would have been possible without support from the Senior Management of the University and co-operation of departmental heads. Such support will always depend on the delivery of results. This submission shows how this "bargain" can work in practice. It is important that it does if MIS is to contribute fully to the development of the institution.
- It is indeed important for MIS practitioners to be actively and creatively engaged with the development of the their institution. As a result of the early demonstration project showing web-based student access to administrative information in 1996, the need to integrate this with academic or learning information was quickly recognised. This subsequently became a key influence on the development of Resource Based Learning in the University. MIS continues to make a distinctive contribution to developing the benefits of web-based technology for students and staff regardless of whether the information content is administrative or academic in nature.
- This leads to the final point, which is that the traditional difference between administrative and academic information must be set aside as we move to the web based delivery of information services. Students are not particularly concerned for

example, with the difference between their study programme and the learning materials required to complete it. Web learning environments often include administrative functionality and some administrative packages deliver learning content. As specialists in information processing, MIS should be well placed to mediate the implementation of the large multi-user database systems which are necessary for web enabled learning on a large scale. The close association with existing administrative information and business processes further strengthens the logic of this.

Appendix 1: Summary History

1989. Management Information Services formed as a small unit within the institution as a result of national changes to the organisation of Higher Education in the UK.

1989 - 1991. Strategic foundation established including:

- Oracle relational database adopted;
- development staff trained in Oracle development skills and tools;
- Oracle CASE adopted as a means to integrate models, methods and technology;
- Personnel System developed in-house as a rapid-response to a troublesome software package and as a early demonstration of benefit;
- formal MIS Information Strategy developed with the support of senior management leading to agreement on several system development proposals.

1991-1993. Development of an extensive Course and Student Management System (CSMS) based on proposals in the 1990 Strategy and anticipating improvements of automation and integration of business processes.

1994-1996. Increasing confidence in the CSMS system within the University encourages consideration of direct access to information and services by students. Increased administrative efficiency is a major motivation.

January 1996. Vice Chancellor sets objective to demonstrate on-line student access to course programme information by June 1996

January 1996 - May 1996. Fully operational prototype system to allow secure, authenticated web-based student access to view/change course programme information.

June 1996. Prototype web-access demonstrated as part of a University-wide Information Technology publicity event.

1996 - 1999. Synergy recognised between student web-based access to administrative information and access to learning information leading to the development of an integrated Resource Based Learning Strategy to steer development into the next century. Also the original web-access prototype further developed, now called Personal Information Pages (PIP) and gradually introduced into live service.

March 1999. PIP project awarded UCISA Web Award for MIS