

Challenges of Complex Information Technology Projects: The MAC Initiative

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EXECUTIVE SUMMARY

Although painstaking planning usually precedes all large IT development efforts, 80% of new systems are delivered late (if ever) and over budget, frequently with functionality falling short of contract. This case study provides a detailed account of an ill-fated initiative to centrally plan and procure, with the aim to homogenize requirements, an integrated applications suite for a number of British higher education institutions. It is argued that because systems are so deeply embedded in operations and organization and, as you cannot possibly foresee and therefore plan for environmental discontinuities, high-risk, 'big-bang' approaches to information systems planning and development must be avoided. In this context the case illustrates the level of complexity that unpredictable change can bring to an information technology project that aims to establish the 'organizationally generic' and the destabilizing effects it has on the network of the project's stakeholders.

Keywords: academic administration IS; information systems development; IS failure; IS/IT planning; IT project management

ORGANIZATIONAL BACKGROUND

Located on the western edge of London, Isambard University received its Royal Charter¹ in 1966 and since then enjoys a considerable reputation for research and teaching in the science and technology fields in which it specializes. Close connections with the public sector, industry and commerce characterize Isambard University. These links were built through a commitment to the thin sandwich² undergraduate degrees which made the University's graduates among the most employable in the country and, by its distinctive competence in applied and strategic research. As a direct result, Isambard University is popular with undergraduates, while its earnings from contract research per member of academic staff are significantly above the national average in most of the cost centers in which it is active.

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In the beginning of the 1990s the Higher Education (HE) sector in the UK started to experience dramatic changes. The Secretary of State invited comment on the scale, purpose and structure of HE, and the Government made its views clear through the introduction of numerous policy changes affecting universities' funding, teaching and research. Those were followed by the merger of the Ministries of Education and Employment, and the move of the Office of Science and Technology to the Ministry of Trade and Industry, signifying an increased requirement for public spending on HE to have a demonstrable effect on employment and national economic growth. For example, in November 1995, a 7% overall reduction in universities funding for 1996 was announced, including a 31% fall in capital funding, meaning that over a six-year period the unit of funding for teaching each student would have had to be reduced by 28%. Direct financial support for students was also reduced. The previous students' allowance scheme was terminated, with the balance between student grants and loans moving even more deterministically towards the latter, with the Government signaling its adamant intention to fundamentally review the funding mechanisms.

It was against this background of environmental turbulence that Isambard University, as indeed every other academic institution of HE, operated. Another one of the key environmental changes was the Government's plan to double the number of undergraduate students, from one million to two million, over a 25-year period beginning from 1989. In the medium term this was to be achieved through a strategy of 'expansion with greater efficiency'. Hence, a major challenge for Isambard University was to determine a plan and assure that the necessary infrastructure was in place for participating in this program of expansion in a way that would build upon and strengthen its distinctive characteristics. Associated with this change was the Government's decision to abolish the Council for National Academic Awards (CNAA³). Institutions with degrees validated by this body were now required to seek alternative means of validation, either through the acquisition of chartered status, or through association with an existing chartered institution. Opportunities to validate the awards of other institutions were therefore available for Isambard University.

Isambard University's strategy of actively seeking growth and diversity, by merging and fostering links with other institutions, came into fruition in February 1995, when the West London Institute of Higher Education was incorporated into the University as Isambard University College. This amalgamation marked the beginning of significant restructuring as the College departments had to be molded into a unified faculty structure. By the end of 1995, the Departments of Education from the two institutions were brought together into a single School of Education, and the Department of Design joined the Faculty of Technology. Furthermore, there were plans involving the splitting of the College Department of Human and Environmental Sciences into a Department of Sports Sciences and a separate Department of Geography and Earth Sciences. In addition, Isambard was for the first time planning to establish an Arts Faculty. This re-organization was the cause of considerable instability.

Adding to these was the intensification of the competition for research funding. Changes in the Funding Council's allocation model were directed towards greater selectivity in the use of research funding and an increased emphasis on research quality and

proven research success. For these reasons, Isambard was experiencing a shift in its funding arrangements and had to obtain external funding to compensate for a reduction in central funds through the Higher Education Funding Council for England (HEFCE). Whereas in the past there were one or two revenue streams to be maximized, now there were at least five. These included:

- Central funding from the HEFCE based on a series of assessments (for example Research Assessment Exercise)
- Project-driven funding from UK research councils and from the European Community
- Collaborative and contract research for industry and commerce
- Overseas student fee income
- Conference accommodation and catering income

Hence it was towards the end of the '80s and the beginning of the '90s that Isambard University found itself exposed to an operating environment that in many respects was borrowing the business — like characteristics of the commercial sector. In the Vice Chancellor's own words:

"The only cloud on our horizon as we start the new year is the uncertainty of the environment in which we will be seeking to put those values [to continue to be a mixed teaching and research university which is financially sound; and to be characterized by teaching and research which is of relevance to its user community] into practice. 1995 entered with less clarity about the future of the UK Higher Education system than most of us working in it have ever known." (Sterling, 1995, p. 16)

SETTING THE STAGE

Information systems played a critical role at Isambard University. Its orientation towards engineering and sciences dictated a high level of interest in, and use of such systems, among other high technology facilities. Since the mid-eighties its systems infrastructure developed from a central multi-user mainframe with islands of computation in the various departments, to a distributed computing system linking central and departmental resources and providing user access at required locations, via terminals, PCs, and workstations. Teaching and research staff, partnering with their close links to industry and commerce, demanded 'state-of-the-art' computing at industry standards. The following elements constituted the framework for the University's computing infrastructure:

- UNIX for main service operating systems
- Networks based on X.25 and Ethernet
- IBM compatibility for PCs
- Adoption of UNIX- based workstations

- Application software of industry standards
- Centralized file service

It was also recognized that all administrative work ought to be underpinned with effective information and management systems. Historically, the administrative computing capability had been developed to service the central administrative functions. As management and administrative tasks and activities by departments and faculties increased, so did the need for support in those areas. This change in responsibility brought about the development, within some departments and faculties, of local systems to support their management and administrative activities and needs. In parallel with this, there was an increasing demand from departments and faculties for management information from central administration and support, in terms of access to system facilities. In 1988, it was observed that in terms of hardware, the host machine supported about the maximum number of peripherals it could, and was utilized beyond the normal expected level. This meant that any further expansion of support was not feasible without increasing computing power and capacity. In addition, the terminal access of administrative systems for individual departments provided via the University's network did not provide an adequate response to those remote users, and the service level did not always fulfill their needs. It was not necessarily the case that the information held within the systems was inadequate, but barriers existed which prevented or hindered its use by the departmentally base staff that needed it. There were also issues associated with the data itself, and it was felt that they could probably be resolved by developing new hardware and software architectures to support the differing needs of the users. In summary, the main issues were:

- **Format and structuring:** Data was not formatted and structured so that it could be presented to the user in a useful and meaningful way.
- **Access:** There was limited access to the data caused primarily by technical constraints.
- **Currency:** Data was found to be current for one set of users but out of date for others, due to differences in need and timescale.
- **Ownership:** There were areas where lack of ownership definition and responsibility had resulted in a lapse in maintenance of the data. Where ownership was at the center, but data was derived from other sources, there were problems in maintaining it. An example was customer records where ongoing information was provided from many sources, but there was no area responsible for collecting the data and no means of distributed input. Any breakdown of communication resulted in central and departmental information being different.
- **Completeness:** There was a wealth of information in all subject areas held by individual departments and within the faculties, which was not captured effectively. The necessary mechanisms (i.e., coordinated and integrated systems) did not exist to enable this to happen.

The software applications processing this data had been developed over the last 12 years. Their development had been tailored to the specific needs of the users that applied at the time of development or subsequent amendment. As management and administrative roles and responsibilities were undergoing change, new users were bringing in a new set of needs to be satisfied. Similarly, changing circumstances — unpredictable demands from the Universities Funding Council (UFC)⁴ and changing rules for allocating funds — and pressures were bringing about different needs. During the period of 1988-1990 it became clear that while the existing systems satisfied many of the central administrative requirements, new needs in both the management and administration of the university arose.

CASE DESCRIPTION: MANAGEMENT & ADMINISTRATIVE COMPUTING INITIATIVE

The UFC's Management and Administrative Computing (MAC) initiative was announced in September 1988. The aim of the initiative was to promote the introduction of more effective and sophisticated systems to support the increasingly complex decisions that faced universities and colleges (Kyle, 1992). In addition, the systems were to provide the UFC with the information needed for allocating funds more effectively across the pool of universities. The cost of institutions 'doing it alone' was estimated at £ 0.5 million or more for each. To avoid this, the Universities Grants Committee (UGC⁵ — precursor to the UFC) commissioned a study to develop an information/data specification or 'Blueprint', which aimed to cover 80-90% of the needs of any single institution. A Managing Team was formed, and an initial study based on direct input from five universities and contributions from 20 more was completed. The team, comprising senior computing staff and university administrators, was chaired by the Vice Chancellor of the University of Nottingham.

The UFC decided that they would only fund information technology developments for MAC that were organized to suit 'families' of universities. The objective was to group institutions into five or six families with similar computing requirements. Whilst geographic proximity was helpful in promoting frequent contact between the family members, it was not to be the only consideration. Others included similarity in size, structure, type of institution, existing collaboration (for example on purchasing), and computing development needs.

The Initial Phases

The Blueprint undertaken by Price Waterhouse (now PriceWaterhouseCoopers) delivered at the end of 1988. The five main participants were Manchester University, Strathclyde University, Newcastle University, University College London and Isambard University.

In March 1989 the blueprint was sent to all universities, together with a request that each university prepare a 'migration strategy' report. This would have to include

each university's present administrative computing situation, both in terms of its computing hardware and its existing applications, and of its development priorities and requirements for the future and additionally:

- A comparison of the information needs of the University with the generalized blueprint and an identification of gaps between the two
- The identification of the characteristics of the institution in order for the Managing Team to classify it
- The development of an outline strategy for migration from the University's existing systems to the outline architecture in the blueprint

Isambard's migration strategy was prepared with the assistance of two consultants from Ernst and Young and emphasized the importance placed by the University on the provision of management as well as operational information. There were also two additional features that were highlighted: one was the need to conform to the University's own Information Technology strategy⁶; the other was the fact that a new development platform had to be selected for any future systems, as the existing systems were coming to the end of their useful life. The preparation of Isambard's migration strategy for MAC took place at about the same time and led to a decision to integrate management and administrative computing systems. This decision for integration was one of the principal factors that led to a commitment to the Oracle database platform as it was the one supported by the University's computing services. This migration strategy was sent to the UFC in July 1989.

The Formation of Families

The MAC Managing Team used the migration strategies submitted by all universities as the basis for the formation of different 'families'. A consultant from the National Computing Center (NCC) assisted in analyzing the strategies. As a result of his analysis and at a meeting held in September 1989, it was proposed that the families should be formed around the four main relational database products available at that time and in use in universities, as the universities believed it to be the most important factor regarding their future systems development. In addition it was thought that this would enable them to achieve the objective of developing a common code to run on their hardware. The products were *Oracle*, *Ingres*, *Powerhouse* and *Secqus*. Each university was then asked to choose which family it wished to join, with the UGC hoping "that, in time, all members of any one family will be using the same administrative computing software which they will develop and maintain jointly." The process of forming the families took place during October 1989 and Isambard joined the largest one — the Oracle Family — which represented a wide variety of universities. Other reasons for this were the size of the family itself — the bigger the family, the smaller the contribution Isambard believed it would have to make — and the viability of the supplier; in terms of sales, Oracle was by far the largest of the four as well as the most 'open'.

In October 1989, the Family was simply a collection of universities that agreed to cooperate on systems development using a particular product. A constitution and *modus operandi* had to be drawn up for the Family in addition to a plan of its activities. This was necessary in order to obtain funding from the UFC. The constitution established a Management Board in which each university had one representative and one vote. A Chairman was elected from among those representatives, and the Family incorporated as a limited company known as Delphic Ltd.

The Board also decided to form a number of what they called *Application Groups*, one for each area of the management and administrative systems identified in the Price Waterhouse's Blueprint. This did not mean that the groups had to undertake the development of the systems themselves, but that they were to be responsible for working directly with the commercial contractors employed by the Family. Each member of the Family had to be a member of at least one group, and Isambard took the decision to join the Management Information Application Group.

The Analysis, Design & Delivery Phases

In February 1990, it was decided to contract Mantis UK to undertake the analysis stage of the Family's systems development program. This involved the production of the functional analysis and data dictionary of the members' requirements, under the sections covered by the six Applications Groups set up by the Management Board: Students, Staff, Finance, Research and Consultancy, Physical Resources, and Management Information. The work on this contract commenced in February and ended in June 1990. It involved several consultants from Mantis UK plus many staff from all the member universities of the Family and was supervised by a Project Manager employed on a consultancy basis, together with a small group⁷ chaired by the administrative computing manager of Bristol University.

The result of all the work — a huge coordinated effort between Mantis UK and the Family members — culminated in an enormous document running into several hundreds of pages which contained everything one ever wanted to know about management and administrative computing requirements in UK universities. It was made up of two main parts. The first was the analysis of all the management and administrative functions that universities needed the systems to help them carry out (the *Function Hierarchy*). The second identified all the data items required by these functions and the relationships between them (the *Entity Relationship Model*). These were followed by proposals concerning the development of the required systems. The document therefore comprised the deliverables from the analysis stage on the basis of which the system was to be designed and built.

The next stage was to commission someone to design and build the systems software on the basis of this analysis and data dictionary. An initial description of the work to be tendered was issued by the NCC on behalf of the Family at the end of April 1990, and expressions of interest in receiving a full tender document were invited. The formal invitation to tender was issued in June to three companies expressing interest. These were Mantis UK, Hoskyns and Price Waterhouse. The Family received the three ten-

ders on August 7, 1990, and spent the rest of the month assessing them. A detailed scoring system was used to evaluate the three tenders against a whole range of factors. This evaluation process was followed by a period of intense negotiation over the costs with each of the suppliers and significant reductions over the original tender price were eventually achieved.

The outcome was that Mantis UK was offered the contract to develop the full set of management and administrative systems. The recommendation was formally accepted by a meeting of the Management Board in September 1990, and a contract was subsequently drawn up with Mantis UK with the assistance of specialist legal advice. The complexities of the negotiations over the contract were such that it was not formally signed until May 1991, although the work itself started and continued during the negotiation period.

Although the MAC system was designed as one closely integrated system, its software was to be made available in phases (see Appendix). All applications, with the exception of payroll, would use *SQL Forms V.3* with pop-up windows etc. as part of the user interface. The Finance application was based on Mantis's own accounting package that was to be enhanced to cater for the additional functionality requested by the Family. Whenever the Mantis development team finished writing and testing a release of software, this was to be passed over to the appropriate Application Group for them to run their own acceptance tests on it. It is important to note that the '80/20' rule applied here. A small part of the system was left to the discretion of the programmers working at each of the universities, who after an Mantis software release and in close cooperation with Mantis developers, would attempt to 'tailor' the system to the specifics of the sites (Pollock, 2001). If an institution was encountering problems in running the software, the 'Delphic Support Desk' had to be contacted. This would assess the problem and then pass the solution back to the institution responsible for the particular application. If the problem could not be resolved, it was forwarded back to Mantis which had to redesign and rebuild the application.

Management & Administrative Computing Initiative Outcome for the Delphic Family

Towards the end of 1994 and with the funding for the MAC Initiative nearing its termination date of March 31, 1995, the Delphic members were experiencing severe delays concerning the delivery of the main application packages. The Anticipated Availability Schedule (see Appendix) shows the time slippages. Kyle (1994) summarized some of the main causes for the delays as follows:

1. The design of the Student Structure was found to be flawed, and had to be redone.
2. Mantis's decision to merge its development team responsible for its own Finance package with the one responsible for the MAC's Finance module.
3. The loss of senior Mantis development staff, particularly during critical design stages.

4. The introduction of a new stage: implementation by a test (lead) institute between the end of acceptance testing and the release of an application in its supported state.
5. The decision of Delphic to make modules available in 'baskets'. This meant that the first module accepted had to wait until the acceptance of the last module in the basket before it could be implemented.

Complementary to the above a number of observations can be made regarding this state of affairs concerning the initiative.

Price Waterhouse's approach for conducting the initial feasibility study (i.e., the Blueprint) was considered hardly appropriate for as complex a system as MAC was. On the basis of the knowledge they had acquired about university administration from developing information systems for Durham and Leeds Universities, and because time was of essence, they adopted a 'drive the user base instead of letting the user base drive you' approach. This meant that Price Waterhouse as in effect designing the Blueprint based on its assumptions of what was needed, and then presenting it to the representatives from a cross-sample of universities, inviting them to comment.

However, the representatives did not have the blueprints in advance to study and to comment interactively with the consultants — they were given to them at the meetings, where at the end a decision had to be made. This, coupled with the large size of the project and its 'open' structure, resulted in some areas being overlooked and others not being looked at in sufficient detail. The final Blueprint was a huge and complicated technical document, and by large the universities did not check it out as they ought to have done. It was of a hierarchical structure cut down to functions described in little detail, which made it difficult for systems personnel to understand, let alone explain it to their line managers and get the much-needed feedback. The fact that this approach was problematic became evident when the families started their own individual developments. They found out that the result was not as much of the Blueprint as they had thought it to be.

The application of the '80/20' rule mentioned in the preceding section meant that the finalization and successful implementation of the various modules was heavily reliant on the skills and efforts of the programmers who were working the code so as to make it compatible to the specifics of each site. But they were tasked to work with the system only in certain ways, as Mantis wanted to ensure that the code would only be modified in the ways they deemed appropriate. In a sense they were "...attempting to configure the local programmers as their users..." (Pollock, 2001, p. 7) and this gave rise to a lot of friction. The following excerpt from a final report to the Delphic Support Desk regarding an issue illustrates this:

"...As you may know, [the University] migrated from [MAC] 1.3 to 1.4 last week and encountered some problems which we helped with. We also advised them to migrate to 1.5, as 1.4 was no longer supported. This they did over the weekend and again had some problems, which I have mentioned in the log. They contacted me on Monday morning and I have been looking at the problem(s) over the last day and a half. We have carried out a few checks and offered some advice on overcoming some of the problems, but it would appear that the problem lies in the

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data that they are working with and not a problem in any of our code... Quite simply, I cannot justify any more time on this problem as it does not appear to be a problem with our software, rather a problem on site which may well require a great deal of time to identify... Their current work-around is to use the basket 4 forms against the basket 5 database. I have expressed my concern over this and warned them that this is unsupported but they appear to be confident that they have an adequate work-around.” (Pollock, 2001, p. 14)

Arguably, the causes for the delays mentioned above can be experienced in any project of MAC’s scope, scale and complexity. However, the first one on Kyle’s list draws one’s attention, as it was the result of an environmental discontinuity that could have not been anticipated — that of semesterization⁸. It was felt as something that was clearly overdue, a departure from a rigid and inflexible academic structure that originated in the beginning of the last century to a more open and clearly cost-effective scheme. As a result of semesterization, Isambard, for example, was able to increase considerably its student numbers by offering a wider range of choice regarding the structure of its courses, rather than only the four-year thin sandwich course option. This change affected mainly the Student Module. The fact that in 1994 parts of it had not been contracted (see Appendix), although the initial delivery date for the completed module was July 1992, shows clearly the magnitude of the effect that this change had.

The Student Module was driven by what was called “*Program Structures*” — schemes of study. “*Program Structures*” was designed in such a way that in an attempt to provide for integration, every single module was required to know what the structure was when dealing with student administration. For example, the Student Registration, Student Finance, and the Assessment and Degree Conferment modules related first of all to the Program Structure and its maintenance, and in effect were totally dependent on it. This module’s development had to start virtually from scratch again because of semesterization, and it was estimated that its delivery had to be put back by a year to 18 months.

Twenty-six months later and there was still no definite delivery date, although an estimation was that a ‘formal’ deliverable had to wait for another two years. Needless

Figure 1: MAC Modules Adopted by Isambard University after Almost Six Years of Systems Development

<input type="checkbox"/> Finance	————▶ Non-Delphic solution
<input type="checkbox"/> Students	————▶ Non-Delphic solution
<input type="checkbox"/> Staff	————▶ Delphic offering adopted
<input type="checkbox"/> Physical Resources	————▶ Non-Delphic solution
<input type="checkbox"/> Research and Consultancy	————▶ Non-Delphic solution
<input type="checkbox"/> Payroll	————▶ Non-Delphic solution
<input type="checkbox"/> Management Information	————▶ Non-Delphic solution

to say, no member of the Family could afford to bear the cost of a product that had not been proven to work, and in which acceptance tests had to take place throughout a whole academic year and be evaluated against the annual cycle of activities. The metaphor of the old lady who is trying to cross the road and waits for someone else to do it first, in order to see if he gets run over, illustrates the case. Angela Crum Ewing, deputy registrar at Reading University (a member of the Delphic Family), said after they decided to hold onto their in-house applications, rather than implement a MAC solution: "MAC is in a position of transition. We did not want to commit to a new, untried system, when we had our own in-house systems which worked well" (Haney, 1994).

A 'sneak preview' of the modules by Family members resulted in a lot of skepticism about the future, stemming from the fact that continuous disappointment would mean dissatisfied stakeholders who will not stop placing pressure in favor of project abandonment. The effect of semesterization had major repercussions not only on Mantis UK as the system developer, but on all members in the Family who were counting on the deliverables and had already made their migration plans. For Isambard University, only the quantifiable costs amounted to the region of more than £50,000 — two extra man-years of further systems development work that no one had anticipated.

CURRENT CHALLENGES/PROBLEMS FACING THE ORGANIZATION

In September 1994, after almost six years of systems development and six months before the termination of the funding, only one of the Delphic modules that were to be made available was finally adopted by Isambard University (Figure 1).

The state of affairs regarding the seven main areas was as follows:

- **Students:** Although at the time Isambard's existing system infrastructure could hardly accommodate semesterization, the administration of the University, tired of waiting for Delphic to come up with a deliverable, was pushing persistently for a new system. In November 1993, after 'shopping around' for any Mantis-based student system in use that could be able to satisfy Isambard's own requirements, a decision was made to consider the system of the University of Liverpool. After some time it was found out that for a number of reasons, this was not the solution either. Firstly the system was designed to meet Liverpool's own requirements in a very specific way and it was never developed as a package for other universities to use. Isambard's own requirements were completely different to theirs. Secondly, it was developed on an older version of Mantis. This meant that its blind adoption would pose problems in the future concerning its integration with any Delphic deliverables. On the other hand, an attempt to modify it would mean major overhead. Finally, from a technical point of view, the system was not documented — a 'black box' in the systems team's own words. Isambard had no alternative but to develop and design its own in-house student system whose first phase went live in the first week of October 1994 to coincide with the beginning of

the new academic year. The system covered the Registration process, but no project was under way regarding the two other main areas — Student Finance and Student Accommodation.

- **Finance:** The development of the Finance module which was a base offering from Mantis UK and which had been enhanced to meet the extra requirements, was also off schedule. As a result, an Mantis quasi-commercial accounting package was adopted and implemented. The package had nothing specific to offer to universities, and if there were a choice, it would have not been taken on board by Isambard. It was developed by Mantis UK (in much the same way as Price Waterhouse delivered its MAC Blueprint) in an attempt to quickly capture a slice of the off-the-shelf software market when it had decided to enter it a couple of years ago. This meant that several enhancements were necessary and it took more than 200 person hours alone to determine whether or not it could replace the existing system. Subsystems to deal with the maintenance of research contracts, and to allow for the issuing of monthly statements of accounts to heads of departments and senior researchers, were designed, and eventually the system went 'live' in August 1994 — the beginning of the new financial year.
- **Staff:** Following the installation and assessment of the pre-release version of the first module from Delphic (Posts, People, Appointments and Organization), the implementation team agreed and the old system was subsequently discontinued in September 1993. It was replaced by this and the second module (Skills, Recruitment and USR Return). However, at that time (September 1993) Delphic still had not provided any documentation for the system.
- **Physical Resources:** The initial Delphic offering proved to be an 'overkill' for Isambard's requirements. It provided more than was actually needed, and two key areas had already been covered by in-house-developed Mantis systems. One area was the administration of the University's own housing facilities and the people who occupied them, and the other was an inventory system for mobile equipment. The Delphic offering still held some level of attraction to Isambard's Management Services team, but only when used in conjunction with the Delphic Finance Module, as it offered the facility the option to debit directly a departmental account at a store as soon as an item was issued out. The Stock Control Module was at the time running at test mode, but as these two packages were designed to be highly integrated, there was a deadlock situation as the Finance module had not been delivered. Moreover, as mentioned above, a commitment had been made to the in-house-developed finance system, which was unlikely to be replaced for at least two years.
- **Research and Consultancy:** No view had been formed about this module as there had not been a delivery. Supposedly it provided the ability to maintain profiles of staff and possible customers who could require applied research to be undertaken by the University on their behalf. An in-house-developed Mantis system was then in operation centered around publications of Isambard staff and information on customers. The accounting side (e.g., the recording of costs against

research projects) was partly accommodated by the core finance system. Again, it was rather like Physical Resources — nothing particularly attractive given the overhead in implementing either of the Delphic modules that tended to be reasonably sophisticated for Isambard requirements.

- **Payroll:** A bureau service from a leading UK bank catered for the payroll function at Isambard. The consensus of the Director of Financial Services was that it was adequate, and therefore he was cautious and opposed any change. What were however lost by this decision were the integration and the economies, such as saving in paperwork and clerical time that came with the Delphic module, and that were associated with raising the cost of various processes between the two interconnected functions — payroll and personnel. However, the high level of integration offered between Delphic's Payroll (not delivered at that time) and Staff modules were attractive to Isambard, as it had implemented the latter. After some careful consideration it became clear that its adoption was very unlikely to happen, as at the outset it seemed a very general package; again, many enhancements would have been necessary. This was a significant requirement considering the size of Isambard's Management Systems Team and its constrained time scales.
- **Management Information:** Similarly, no 'final' view was formed. There had been a development where Management Information was considered to be the 'Cinderella' module — the sort of one where by residing within the other modules, management information requirements at a strategic level could be easily accommodated. In September 1994, only statistics of various sorts could be generated for Government use, and those with considerable difficulty. In order to cure the problem, Delphic bought the rights for individual universities to acquire *Holis* — a powerful expert system, as there was general consent that Mantis UK was delivering 'textbook' systems. This meant that they had gone too far in terms of splitting down to tables for the database, without considering that most legacy systems already in place at universities were hierarchical, thus operating with one table. This transition posed a considerable challenge. It required a lot of effort and man-hours for the Management Services team that had to undergo the process, as *Holis* was not available when the initial design decisions were made. *Holis* was generally looked upon as the solution in gluing and running the whole of the independent databases together as it could accommodate any set of computerized data-like spreadsheets and flat files which did not necessarily have to follow Delphic's database format.

The MAC Initiative was funded from 1988 to 1995 and a total of 11 million were invested in those seven years. "Universities snub software policy," read a headline in *Computing* (September 22, 1994) — a professional trade magazine. "UK universities are going their own way to buy core administrative software after finding a government-sponsored scheme out of touch with their business needs," the article continued. Birmingham and Reading Universities both confirmed in September of that year that they were moving outside the MAC initiative for their latest developments, and the University of Sussex being dissatisfied with the delivered software for Undergraduate student

admissions eventually chose a separate system. With the funding for MAC running out in July 1995, similar moves from other institutions were being planned, as there was no other viable alternative.

The outcome was that although Families continued to exist in a rather informal way, MAC-related activity slowly came to an end after the central funding terminated. The Delphic and Mantis UK Management Boards agreed and concluded their contract at the end of April 1996. The agreement was to deliver all remaining software in an 'as-is' state at the end of January in order to be tested at the University of Liverpool. The software was to be accepted at the end of February, with any 'bugs' to be remedied under the warranty agreement. Delphic was to make no further development demands on Mantis (Philips, 1996). It is without doubt that many interpretations can be given regarding the final outcome, and in retrospect each Family managed to achieve the objective of producing software to cover a number of the Data Blueprint areas. Some of these systems did run quite successfully in a number of institutions (Hillicks, 2002). What must be noted, however, is the fact *that no University managed to achieve the initial objective of using only the MAC modules exclusively.*

The ending of the contract meant that Delphic was in total control of the situation rather than having to work through Mantis, and in 1996 MAC was a far cry from the initial objective for an integrated information system where all the functional subsystems could be seamlessly linked so that one would not end up with a collection of disjointed and ineffective systems (Kanellis & Paul, 1995; Kanellis, 1996). For Isambard University in particular, the main attraction in joining the Delphic Family was the integrated solution that they were offering. Graham Kyle, manager of the Management Services team, summarized eloquently the situation: "...as you can observe, the way we are staggering here at Isambard, there is no sign of integration as far as we are concerned." One feature of Delphic that did not apply to any of the other families was that from day one the deliverable was designed as one system. It caused Mantis UK problems because, when the first major slippage occurred (the Students Module), Mantis had to respond to pressure from the Delphic representatives who demanded some deliverables." This meant that Mantis had to unbundle the system by separating and redesigning the links, a major cause for MAC's failure to meet deadlines. Almost all deliverables were at least two years late, according to the dates quoted by Mantis UK in the original specification, and this caused considerable stress and frustration to Isambard, which had to decide which route to follow regarding its infrastructure: to wait and see how Delphic would handle the situation after the termination of the contract with Mantis, to see how to integrate the various probable solutions described in the beginning of this section or to make a fresh beginning abandoning all previous investments? Difficult choices indeed and hardly the type one expects to be faced with at the end of an information technology development project that started with the best of expectations.

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ENDNOTES

- ¹ Royal Charters have a history dating back to the 13th century. The original purpose was to create public or private corporations and to define their privileges and purpose. Nowadays, Charters are normally reserved for bodies that work in the public interest and can demonstrate pre-eminence, stability and permanence in their particular field. Many older universities in England, Wales and Northern Ireland are also chartered bodies.
- ² Sandwich courses involve a period of work in industry or a commercial organization. On a 'thick' sandwich course, the student spends the third year working away from university. The 'thin' sandwich course has placements lasting six months each calendar year.
- ³ The CNAAs were founded by Royal Charter in 1964, with the object of advancing education, learning, knowledge, and the arts by means of the grant of academic awards and distinctions.
- ⁴ UFC became the Higher Education Funding Council for England (HEFCE) which was established following the Further and Higher Education Act 1992. A principal feature of the legislation was to create one unified higher education sector by abolishing the division between universities and polytechnics.
- ⁵ Under the education Reform Act of 1988, the University Grants Committee (UGC) was replaced with the Universities Funding Council (UFC) which in turn was replaced by the Higher Education Funding Council for England (HEFCE) to conform to the Further and Higher Education Act 1992 which made provision for a

single system of higher education, with a unified funding structure and separate funding councils for England, Scotland and Wales.

6 It was during 1989 that Isambard University was required to prepare a renewed internal information technology strategy to support its bid to the UFC's Computer Board for funds related to academic computing from 1990 onwards. The principal objective of the strategy was to make available a range of integrated computing facilities to staff and students throughout the University using an infrastructure of distributed computing based on campus networking.

7 Members comprised of the chairmen of the six Applications Groups, plus a couple of other members nominated by the Management.

8 A standard of measurement in higher education used to group weeks of instructional time in the academic calendar. An academic year contains a minimum of 30 weeks of instructional time. An individual semester provides about 15 weeks of instruction, and full-time enrollment is defined as at least 12 semester hours per term. The academic calendar includes a fall and spring term, and often a summer term.

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APPENDIX

Delphic Family Schedule of Deliverables

(a) DELPHIC Family Initial Schedule of Deliverables

1990/1991	1991/1992	MARCH 1993
STUDENT REGISTRATION, FEES, EXAMINATIONS	FULL STUDENT SYSTEM	MANAGEMENT INFORMATION & ALL SYSTEMS
FINANCE PHASE 1	FINANCE PHASE 2	
PAYROLL PACKAGE	PERSONNEL PHASE 2	
INTERIM PERSONNEL PACKAGE	RESEARCH AND CONSULTANCY 1	
	PHYSICAL RESOURCES PHASES 1,2,3	

(b) DELPHIC Family Schedule of Deliverables (as at 30.09.1994)

Module	Applications	Design	System Test	Acceptance Test Signed- Off
FINANCE	Sales Document Input	11/91	2/92	10/92
	Purchase Document Input, Budgets & Commitments	11/91	2/92	10/92
	Sales & Purchase Ledgers	4/92	3/93 (1)	4/93
	Nominal Ledger	2/93	5/93 (1)	(3)
	Payroll Integration	1/93	3/93	(2)
STUDENTS	Program Structures	5/92	8/92	1/93 (3)
	Registrations	11/92	12/92	(3)
	Student Finance	10/92	3/93	(3)
	Admissions	10/92	3/93	7/94
	Assessments	10/92	8/93	(3)

(b) DELPHIC Family Schedule of Deliverables (as at 30.09.1994) (cont.)

Module	Applications	Design	System Test	Acceptance Test Signed-Off
PERSONNEL	Degree Conferment	3/93	8/93	(3)
	Timetabling	(4)	(4)	(4)
	Accommodation	(4)	(4)	(4)
	Alumni	(4)	(4)	(4)
	Posts, People, Appointments & Organisations	11/91	3/92	6/92
PAYROLL RESEARCH PHYSICAL RESOURCES	Skills & Recruitment	12/91	7/92	1/93
	Absences & Occupational Health, Committees, Reviews	15/1/93	12/3/93	7/93
	Superannuation	11/92	3/93	6/94
	Integration			
	Stand Alone	-	10/92	(3)
	Integrated	6/92	3/93	(3)
	Project Application	2/93	3/93 (1)	(3)
	Research Projects	2/93	3/93 (1)	(3)
	Asset Register & Allocation	10/91	4/92	6/92
	Stores Control & Management	10/91	10/92	2/93
	Job Progress & Costing	6/92	1/93	3/94

(1) Denotes specific dates agreed by Mantis; (2) Denotes acceptance test failed; (3) Denotes awaited; (4) Denotes not yet contracted