14

Developing an information systems strategy for the National Museum of Science & Industry

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14.1. Introduction

In the autumn of 1992 the National Museum of Science and Industry (NMSI) had reached a point at which the replacement of its major computer systems was necessary, and new Information Systems (IS) were also required in certain areas. To provide a strategic framework for these developments, and to help optimise the benefit to NMSI in allocating its technical resources, an Information Systems (IS) Strategy Study was carried out. The 40-day study was undertaken by Roger Lees from the Strategic Assignments Consultancy Service of the CCTA (the Government Centre for Information Technology) and Ben Booth, Head of IS at the Museum, between November 1992 and January 1993. The present paper summarises the study report (Booth & Lees 1993).

A steering group was formed at the outset of the study, consisting of representatives from the major divisions within the Museum. The group approved the terms of reference for the study, and oversaw its overall progress. In addition the steering group met regularly to review the products of the study, and particularly contributed to the identification of the Museum's objectives and priorities with regard to information systems.

The overall approach followed the CCTA guidelines for such studies (Bunn *et al.* 1989), which consists of the following stages:

a) Scoping study
   - To determine the current state of business planning
   - To decide the areas of the business to be covered by the strategy
   - To define the work required to produce the strategy
   - To secure management commitment

b) Strategy study
   - To understand business and policy issues
   - To identify ways of using IS to address them

c) Strategy definition
   - To define which recommendations of the study will be implemented
   - Implementation planning

d) Implementation planning
   - To plan the implementation of the strategy

It was decided that the study should concentrate on defining priorities for IS development, and on defining the appropriate technical environment. A detailed analysis of data would not be undertaken, as the resources available to the study would not be sufficient to perform this in addition to reviewing the strategic and technical analyses, and it was felt that such an analysis could follow on from the main study.

In order to gain an understanding of corporate objectives, the various functional areas, present activities and future needs, a total of 40 senior managers and others were interviewed. Major information stores in both manual and computerised form were recorded. From the information collected, a high-level analysis of the information systems involved, and an assessment of the impact which improvements would have towards objectives, was formulated. A range of broad options was considered, and an overall strategy was defined. In parallel to this analysis of the Museum's objectives, structure and needs, a review of the extant information technology (IT) systems was undertaken, and technical options were compared, so as to establish the recommended technical architecture. Combining together the IS and IT strands, a strategic plan was proposed, prioritising projects according to their cost, benefit and other considerations. Organisational issues were also addressed, and a list of recommended actions compiled.

14.2. Findings of the strategy study

14.2.1. Background to the business environment

The NMSI is a Non-Departmental Public Body, responsible "at arms length" to the Department of National Heritage (DNH). It comprises the Science Museum (SM) London, the National Railway Museum (NRM), York, and the National Museum of Photography, Film and Television (NMPFT) at Bradford. There are stores at Blythe House and Hayes in London, and at Wroughton airfield near Swindon. The collections contain about 200,000 objects and 2 million images. There are about 2.5 million visitors per annum, increasing at SM and NRM, and there are some 600 staff. The annual expenditure of the NMSI is about £26 million, with the Grant-in-Aid from the Department of National Heritage of about £22 million. However with Government support declining year on year in real terms, the Museum has to rely increasingly on other sources of income. Thus admission charges, retail income, corporate hire and sponsorship, collected via the NMSI Trading Company Ltd, are of increasing importance.

The professional emphasis is on quality, the collections, the promotion of the public understanding of science, and in serving visitors to the museums. The NMSI enjoys a high reputation for its collections, for the presentation of scientific objects, and for its educational undertakings. It is possible to display only 10% of the objects, the remain-

der being in store. In the last few years this curatorial-oriented organisation has put more emphasis on service to visitors. Curatorial values have not changed, but the organisation has become more service- and market-oriented. Measures of success in attracting and serving visitors are reflected in the recently introduced Performance Indicators, which also encompass quality of service, collections management, accountability and value for money. Further indicators record buildings management and income generation.

14.2.2. Objectives

To compare the impacts of alternative opportunities for allocating IS resources, categories of benefit were established relating to the corporate objectives. These were identified as:

- improving the value of Performance Indicators
- improving collections and their use
- improving the service to the public
- improving the organisation
- reducing running costs
- improving efficiency
- increasing revenue

Improving quality was an aim within each of these areas. Potential new information systems would need to be assessed for their impact in these respects, and some systems may have a direct bearing on particular Performance Indicators. Those benefits which the study found to rank highest in determining the allocation of resources and in developing systems, were those to be gained from improving:

- the management of the organisation (through better management information and greater efficiency)
- collections information and their use (including all information resources such as libraries, for better enquiry-handling, *etc.*)
- the service to the public (in convenience, interest, value or range)
- revenue generation and cost saving.

14.2.3. Functions, structure and major centres of information

The study reviewed the overall functions of the Museum from a Science Museum perspective, and then examined the specific circumstances at NMPFT and NRM. In addition the study considered in outline the main types of information in the organisation, the major centres of this information and the access required, and the needs for intercommunication, information flow and exchange.

The subject matter of the organisation was found to be in two main forms; the physical items themselves (objects, photographs, books and so forth in the collections) and the information or base of knowledge about the subject and describing these objects. The largest information systems were found to be those on collections and for the library. These are essentially text-oriented, though there is a growing interest in image information. There are also many administrative information systems, typical of any business, for finance, personnel, and so forth.

Under the strategy hitherto, these large systems have been centralised (on the Prime computer). There is wide-

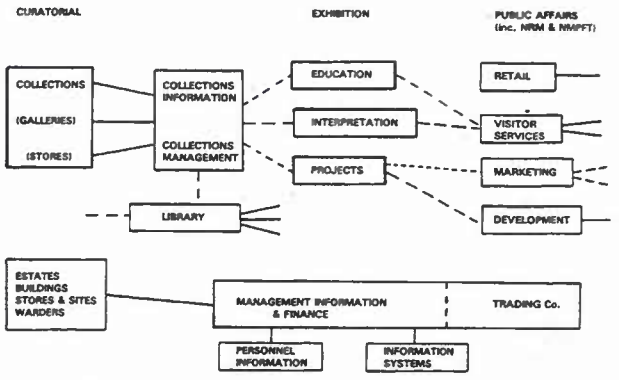

Figure 14.1: Concentrations of information.

spread connection to them (via terminals and PCs), but no inter-linking between systems. Many units also have their own local systems, mainly served by PC software packages. Figure 14.1 illustrates the concentrations of information, which closely matches the organisational divisions of NMSI. Much of the interest and development work has been to improve systems within the individual units, whether these systems are centralised or local. It was felt that this was to be expected, as in most organisations about 80% of a unit's information is within that unit.

In NMSI, there is good access to central systems (subject to communications and performance problems) and to a unit's own local systems on PCs. However there is now an interest:

- to connect local systems to the central ones
- within units, to share access to local data (via small local area networks, each serving a particular work group)
- to exchange information with other people and groups.

Broadly the organisation is seen to be at that state of maturity in its information systems where the major central systems are in place (but need to be updated) and there are many small (but isolated) local systems. The next step should be to provide the connectivity referred to above.

As in most organisations, staff concentrate on their own work, but in NMSI, more than most, the study found that there appeared to be a weakness in the level of intercommunication between groups, in that they do not make as much use of each others information as they might. This was apparent in the interviews, and in early reporting this finding was generally acknowledged. The reason is partly due to geographic separation and to the arrangement of diverse buildings within every one of the main sites (SM, NRM and NMPFT). Whilst there are many committees which help to reduce this effect, the study recommended that the organisation would benefit greatly from any means of improving the synergy across it. The IS Strategy should therefore promote facilities which:

- enable interconnection of systems
- allow more staff to access a wider range of systems
- encourage a wider base of common knowledge of NMSI information and issues

- make it easier and quicker (and economic) for staff to communicate with each other.

This calls for:

- a communications infrastructure across the organisation
- standards for systems (to allow interconnection), for data definitions (for data exchange) and for procedures (for ease of use)
- new methods of communication (e.g. electronic mail and video conferencing)
- management of the technical configurations (for co-ordination, development and maintenance).

14.2.4. Impact of candidate applications on objectives

The study reviewed the types of system which contribute to each of the objectives outlined in section 14.2.2 above, and compared their total impact or benefit measured in these terms. It was found that the greatest impact towards corporate objectives can be expected from (score appended):

- Infrastructure (9)
- Replacement Finance/Personnel/MIS (8)
- Replacement Collections & Registry (8)
- Electronic mail (6)
- Collections Record Centre (public access to collections records) (6)
- Projects management (6)
- Image storage — NMPFT/South Kensington (6)
- Replacement Education Booking System (6)

14.2.5. Review of existing IT based systems

Information Technology is widely used in the Museum to support core activities, to increase individual productivity, and to supply information to the public.

In 1982, stimulated by the acquisition of the Wellcome collection, the Science Museum acquired the first of several generations of Prime minicomputers in order to automate its records of objects. Other applications were added, and the major uses of this central computer now include (in addition to collections) the library catalogue, financial and management accounts, personnel records and the registry database. In addition to this central facility microcomputers are used for word-processing and simple administrative tasks. There are also numerous computer controlled gallery displays.

In order to ensure standards, compatibility and the economical use of resources, overall policy for IS and IT is guided by the IS Committee. The Museum has promulgated its policies with regard to the Data Protection Act, the Computer Misuse Act, and the Copyright Acts, and the provisions of the EC Directive on workstations are being implemented within NMSI. The procurement and support of curatorial and administrative IT in South Kensington, Bradford and York, are provided by the Information Systems Section which is based in the Resource Management Division at the Science Museum. There are also other centres of IT expertise; the building and maintenance of computer driven displays is handled by the AVEC unit based in Public Services Division in South Kensington, and there is a similar facility at Bradford; there is also computing expertise within Collections Management Division, and throughout NMSI there is an increasingly sophisticated body of computer users, many of whom have their own computers at home.

Major computing applications in NMSI are based on the Prime minicomputer, located in the Science Museum Library at South Kensington. These include:

- Object Records
- Library Catalogue
- Financial and Management Accounts
- Personnel Records
- Registry Database

The Prime is permanently linked to most parts of the South Kensington site, to NMPFT, to NRM, and to stores locations in London, and there is also access to the Imperial College Computing Centre, and the Joint Academic Network (JANET).

There are over 250 IBM compatible personal computers (mainly Opus) installed, and a further 30 Apple Macintoshes. They are used for:

- Word-processing
- As terminals to the central computer
- Desk top publishing
- Spreadsheets
- Databases
- Project management

Other systems include an education booking system at South Kensington; an image archiving system at York; a box office system at Bradford; building management systems at Bradford and York, and a small network within the Development Department of Public Affairs Division at the Science Museum.

14.2.6. Options for the development of IT based systems

The study reviewed the overall system architecture which could be adopted. The present arrangement is for the Museum's computer needs (with the exception of word-processing, spreadsheets and small local databases which are on PCs) to be provided for by a single multi-user computer located in the Science Museum. A variant of the architecture which centralises computing in South Kensington is to split the applications so that those not directly related are on separate computers. For instance Finance and Personnel would be on one machine, Collections and Registry on another, and the Library on a third. An alternative, the decentralised model, would have one or more computers located at each of the three museums. Such an option makes the local systems more responsive to local needs, but introduces an additional requirement for standards maintenance across the whole institution. An extreme form of the decentralised model would have processing performed on many "super microcomputers". This is appropriate where the data and applications can be broken up into small granules, but greatly increases the requirement for standards maintenance and data aggregation across NMSI.

The study concluded that whatever the disposition of processors, the network infrastructure was the core of the recommended architecture. It would enable users at the three museums to connect to computer systems wherever

they are located. The network cabling should be of a type to support present data-processing needs, and image transmission in the future. It is likely that TCP/IP and ETHERNET will be the main protocol, but others may need to be supported. Connections should be available to all desk-based staff, most of whom now have personal computers, which should be connected to the network. The location of processors connected to the network will need to be decided on an application by application basis. Initially it is likely to consist of the MIS/Finance/Personnel system, as well as the present Prime. For collections a decision on the best configuration will be needed. Connection will be required to Imperial College, and to other external services, particularly JANET.

A single database management system should be selected as standard for all of the museum's major applications. This should be one conforming to the "relational" model, and is likely to be selected from Informix, Ingres, Oracle or Sybase. The applications informing this decision will be MIS, and Collections. A single operating system environment should be selected for major applications in the Museum. Environments which are able to support both the MIS and collections areas include both Unix and Novell. Taking account of the scale of database and the number of users on the network, Unix appears to be more suitable.

14.2.7. Strategy options and the recommended strategy

Three possible overall strategies emerged:

- Least Action Strategy
- Strategy for Infrastructure
- Strategy for Specific Applications

The "Least Action" strategy would not be a viable option for the Museum, as the main software systems were all in need of replacement, and the Prime minicomputer also had only a finite life. Under the Specific Applications Strategy, the benefits from local applications are more identifiable and quicker to achieve, and more systems can be afforded. There is good support for the bottom 2 of the 4 high-priority objectives (service to the public & revenue and costs), but many aspects of the top 2 (management of organisation & information resources and their use) cannot be well addressed. Adding communications later would be harder. Under the Infrastructure Strategy, systems can help the co-ordination within the organisation (the whole of NMSI), and give more users the benefits from information resources, strongly supporting the top 2 objectives. The bottom 2 objectives are also well supported (as in the Specific Applications strategy), but fewer local systems can be afforded yet, unless by local funding.

The highest-priority objectives require the communications of the Infrastructure Strategy, which supports core systems and gives more and wider benefits over time. If this strategy is adopted, it will still be possible to gain early benefits of many specific local applications, but local funding will be required — ensuring the discipline of justification! Therefore the recommended IS strategy for NMSI at this stage in its development is:

- to concentrate on establishing and gaining the benefits of an improved infrastructure — widespread communications and new core systems (for Finance, MIS and Collections)
- to move the Library onto the Imperial College system
- to co-ordinate the procurement and support of specific local systems, when justified, out of local budgets.

14.2.8. Prioritisation

The relative costs of the candidate applications were considered, and compared with the benefits quantified in section 14.2.4. The following applications are identified as high priority (score appended):

- Infrastructure (24)
- Replacement Collections & Registry (24)
- Transfer Library to Imperial College (24)
- Replacement Finance/Personnel/MIS (23)
- Estates — systems to improve record keeping (22)
- Replacement Education Booking System (22)
- Electronic mail (21)
- Collections Record Centre (public access to collections records) (21)
- Projects management (21)

14.2.9. Organisational issues

The study also considered various aspects of the IS Strategy which relate to the way IS is to be managed in NMSI, and provided recommendations for the support for IS/IT; for the management of major projects, for local systems and their relationship to the IS Strategy, for charging, for standardisation, for development, and for training.

14.2.10. Recommendations and conclusions

The highest priority objectives which information technology can address were identified as improving the management of the Museum, improving information resources and their use, improving the service to the public, and improving revenue and cost effectiveness. Taking account of the need for communication between local systems, the necessary replacement of the present central systems, and the widespread deployment of personal computers, it was concluded that the time is ripe for the installation of a comprehensive communications infrastructure. In addition to confirming the overall programme to replace the present outdated central systems, the study has drawn attention to a weakness in the intercommunication between groups, and to the benefits to be derived from greater synergy.

The new infrastructure will provide access from any location to central databases such as the new finance, personnel and Management Information System (MIS) located at South Kensington, and will also provide electronic mail communication throughout NMSI. Access to information resources such as the telephone list, Events Diary and other common information will also be available. The Library database in its proposed new location on the Imperial College computer system, and external services such as JANET will also be available to users at all locations. It will also

be possible to connect the Prime to the new infrastructure to improve communications for the remainder of its life. Local communication and access to databases will also be supported.

14.3. Conclusion

The findings and conclusions of the strategy study report formed the basis of a submission to the Museum's Executive Management Committee on the way forward for IS and IT. Senior management approved the infrastructure initiative, and the overall priorities for candidate applications. These policies are now being put into practice. Procurement of the infrastructure, finance and personnel systems are in progress, as is the transfer of the Library catalogue to the system managed by Imperial College. Design work for the new collections system has started. Detailed data analysis is proceeding on an application by application basis; where shared data is identified this is co-ordinated between applications. By mid-1994 the major elements of the strategy will be in place, and it will be possible to begin to assess how effective the overall infrastructure is in encouraging the synergy which was identified as being so desirable in the strategy study.

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