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Strategies for Introducing New Information Technologies to Library Users

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Introduction

Libraries in information rich environments, such as institutions of higher education, are critical to the organisation's success. The library is an important sub-unit within the organisation and exists to support the rest of the organisation by providing information and facilitating the flow of information to the rest of the organisation. In a world increasingly dependent on information and one in which information sources multiple by the day the library has a critical role in the functioning of educational organisation.

The technological changes in information processing and the choices that are now available make it critical for libraries to adopt strategies that will both improve existing delivery systems and recognize new emerging technologies. This problem of improving information systems and developing new ones is endemic in most organisations and is not unique to libraries. It is the purpose of this paper to examine the application of ideas, from influential theorists in strategic planning for information systems, to the library situation.

The paper brings together two main themes. The first is the organisational structure of both libraries and the institutions of higher education within which they exist, and the influence of these structures on the development of information systems strategies (Mintzberg 1989). The second theme is the formulation of information systems strategies and here the work of Earl (Earl 1989) is combined with organisational structures to give a framework within which we can consider library information systems. These information systems theories are particularly relevant to libraries as information is the main rationale for their existence. They also enable us to fit libraries into the wider community of information systems and help us draw on experience in other areas.

We start with a discussion of organisational structures and methods of formulating information systems strategies. These are related to our own library and we show how many of the existing library functions fit within the framework and how the theories explain many of the things we do. Finally we extrapolate from the experience of other organisations and discuss possible library developments.

Organisational Structures

In considering how libraries introduce and develop information technologies we first look at a typical organisational structure of a library and the organisational structure of the establishment it serves. Most libraries in higher education have a different organisational structure from the host organisation.
Mintzberg categorises organisational structures under the headings of:

- simple structure,
- machine bureaucracy
- divisionalised form
- professional bureaucracy
- adhocracy
- missionary
- political

Within any particular organisation or sub-unit different structures may exist, but a structure defines the broad parameters of how the organisation operates. The different structures have distinguishing characteristics. A paraphrased summary of the structures and characteristics from Jordan (Jordan 1989) are:

Simple structure

- the organisation as a system of formal authority – the division of labour, reporting levels and flows of authority, as represented by the organisation chart,

Machinery bureaucracy

- the organisation as a system of regulated flows – work materials, information and decision processes are systematically and explicitly controlled; this can be observed as three distinct flows: operating work, regulated control and staff information,

Divisionalised form

- the organisation as a system of informal communication – both work-related and social communication that takes place through channels other than those officially planned,

Professional bureaucracy

- the organisation as a system of work constellations – groupings of people who together carry out major functions

Adhocracy

- the organisation as a system of ad hoc decision processes – the ways in which exceptions and commitments to action are handled by the organisation,

Missionary

- the organisation as a mechanism to promote an overriding ideology - coordination through the standardisation of norms of operating and,

Political

- the organisation as a system of independent self interested entities - little coordination of common goals and characterised by confrontation and alliances.

Almost all libraries can be characterised as machine bureaucracies while institutes of higher education are dominated by professional bureaucratic structures.

These differences in structures explain some differences in the ways libraries operate and react and may even explain perceived cultural differences between library professional staff and academic staff as reported in Bechtel (Betchel 1993). These possible conflicts are not explored here, but is an interesting area for speculation.

The study of machine bureaucracies has dominated management thinking and there is a wealth of material on how to run such organisations. These organisations exist to provide efficient cost effective services and goods and through their formalised procedures, specialised work, hierarchical structures they provide us with many of the advantages of modern life. However, their very efficiency can be a problem when the environment changes and the services the organisation offers move in new directions. Mintzberg suggests that such organisations have long periods of stability punctuated with periods of strategic revolution as the organisation adjusts to change. The mechanisms of adaptation are often traumatic and difficult to control. It is these changes in the environment and how the library can adapt itself that this paper addresses.

While institutions of higher education have many of the trappings of machine bureaucracies they have the stronger structure imposed by the large number of professional teaching staff. While they are bureaucracies they are less hierarchical and individual staff have more control over their own activities. These staff have loyalties to their professions and much of their work is controlled by wider considerations than those of the institution. These organisations are resistant to change and they have problems of compartmentalisation of different areas and misuse of professional discretion.

The structure of both the library organisation and the teaching institution means that both are resistant to change which may be necessary to cope with a changing environment. The organisation structure of both libraries and educational institutions have changed little since their establishment. This comfortable state may not be sustainable due to the impact of new technologies. Of all the organisation structures in Mintzberg's classification the **adhocracy** and **simple structure** are best suited to cope with change. On the basis of these ideas the paper makes suggestions that may help libraries adapt.

Strategies for the Introduction of New Information Technologies

Libraries are continually faced with an increasing number of choices of new technologies. We need methods to evaluate and select those ones that will be most cost effective for our own situations. A model to help select information technologies can be found in **Michael Earl**'s methods for developing information strategies.

The approaches can be summarised as:

- top down
- bottom up
- inside out

The **first** is driven by top management and organisation objectives. In this approach management set the organisations' goals and matches the tasks to the requirements of the organisation. This approach is often synonymous with ideas on strategic planning. The top of the hierarchy determines the overall strategy. This is then broken down into subgoals for the different sections in the rest of organisation. In a stable environment this approach is useful and can lead to a refinement of existing systems. It is particularly suited to machine bureaucracies as the structure of the organisation fits the development strategy.

The **second** approach is driven by considering incremental improvements that can be made to existing practices. In this approach continual evaluations are done of existing practice. Surveys and audits are carried by users and specialists. Systems are fine tuned to provide better service. This approach has echoes of time and motion studies and is a particularly effective method of tuning an organisation to give better performance. Again it fits in with the machine bureaucracy structure and many instances can be found of such improvements.

The **third** approach is driven by intrapreneurs(Schauder 1987) and champions of technology within the organisation. This approach is not compatible with the structure of libraries or of educational institutions. It is tuned to Mintzberg's adhocracy structure and is characterised by risk taking, by vision and by intimate involvement in decision making of the people who carry out the processes. It will be argued that this approach is needed to cope with new technologies, and that the organisational structure of libraries needs modification to allow this approach to flourish.

Examples of how the information systems have developed within the HK Polytechnic illustrate the top down and bottom up approaches. There have been no examples of the third approach.

Development of Systems within the Library

As a typical machine bureaucracy the Hong Kong Polytechnic library is efficient and stable. Over the past decade indicators of work done, such as total number of people using the library, total number of acquisitions, total borrowings and total inter-library loans have all increased at a much higher rate than the number of staff. In particular the number of professionals in the library has been remarkably constant since 1980. Within this environment of stability and standardised work practices, it has been possible to make major productivity and systems improvements.

The library has an integrated on-line system that is described in Cheng(Cheng 1992). This system has been through upgrades and continuous development over the years. It is a typical organisation response of automating and improving standard processes. In Earl's terms it is a bottom up development.

Another more innovative development has been the design, development and implementation of a unique image database of slides. The Hong Kong Polytechnic slide collection acts a teaching and learning aid to the staff and students of the Swire School of Design and to the entire Polytechnic community (Burton 1990)

The catalogue of developments and improvements in the library are impressive. As expected, for this organisation type, the developments can be categorised as mainly bottom-up. Some top-down developments have occurred as the mission of the whole organisation adjusts and changes. An interesting recent development is the appointment of professional faculty librarians to liase and work with different faculties. This is a response to a mission adjustment of the host organisation as it moves to university status.

While it might be comfortable to think that the library can continue with incremental improvements this is not the experience of other machine bureaucracies. These organisations are subject to long periods of relative stability punctuated with occasional bursts of strategic revolution.

A Quantum change for the library?

Short sharp changes in strategies for machine bureaucracies has developed as a theory to explain observed behaviour in a large number of organisations (Miller 1984). He calls these quantum changes. We can observe them happening today in organisations such as IBM and Russian government bureaucracy. While the Hong Kong Polytechnic library is not comparable to these organisations, it is still subject to the same forces of change.

The ability of technology to deliver information electronically will create a demand for change in our library. The technology of the photocopier has already created a new demand for services. The graph in figure 1 shows the demand for books, measured by book loans and the demand for journal articles, measured by inter-library loan requests. Using 1980 as a base year the graph shows the relative increases over the years.

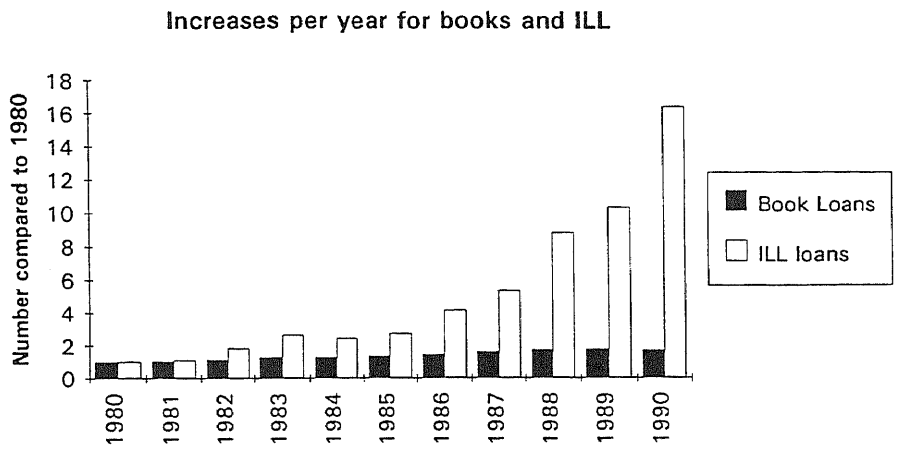

Figure 1

Figure 2 also compares the demand for journals as measured by journal subscriptions against monograph acquisitions. The interesting aspect of this graph is the continual increase in the number of journal subscriptions and the relative stability of the monograph acquisitions from 1985.

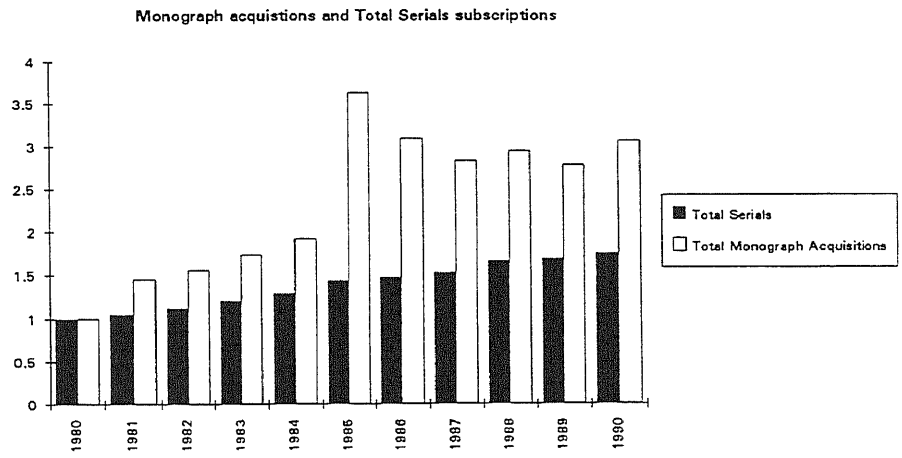

Figure 2

These figures are no surprise to most readers as informal communication with other libraries indicates that same figures are repeated throughout the world. The important change is not the physical form of the photocopy but the more fundamental change of the delivery of "just enough" information. Users want Tailored Information Packages (TIPs). The increase in interlibrary loans is symptomatic of the latent demand for TIPs. This demand coupled with the technology of electronic delivery will cause a quantum change in the way libraries are organised (Brudvig 1992).

This will occur over the next ten years. The situation is somewhat reminiscent of the 1980's that saw the explosion in the sales of personal computers. The technology satisfied the demand for local control and responsiveness and it has caused a quantum change in the delivery of computing.

If it is any consolation to librarians the same technology of electronic delivery of TIPs will cause a considerable shakeup in the information delivery component of education. The professional bureaucracy of educational institutions is in for a similar change as the unmet demand for individualised instruction is coupled with a technology to deliver it.

Libraries still have a few years to adjust to the coming changes, but now is the time to search for strategies to help the adjustment and for techniques for systems development. The only thing we know is that the future will be different and now is the time to experiment to seek the most appropriate organisation structures.

The next section outlines some possible strategies from the literature that have enabled others to deal with change and to seek out new solutions.

Strategies for Change

How do machine bureaucracies traditionally cope with quantum changes? On the evidence we have - not too well. Most of course seem to muddle through, however we suspect that the fundamental change of the electronic delivery of TIPs to users will require radical organisational changes. Libraries will still need to supply their traditional services of storage and classification of books, periodicals and other information sources, but these functions will become subordinate to the main action of direct document delivery. There is another analogy with the computing industry. We still have a demand and need for large computers but the driving force is now personal computing and networking.

The services to support electronic TIPs will require a different form of organisation. The machine bureaucracy will not be necessary because most of the routine work will be done by real machines, not by people acting in a routine manner.

We would like to think a more appropriate organisation structure for this new world is **Mintzberg's adhocracy** and a more appropriate development strategy is **Earl's inside-out** approach. While there will still be a need for the efficiencies of the current structure to cope with the older technologies this is no longer necessary for the new technologies. If libraries are to participate in the delivery of TIPs then they will have to develop appropriate strategies and structures to support them. The world of electronic TIPs is analogous to the manufacturer who goes from a world of standardised products to a world of individual customization.

An appropriate supporting structure is one in which individual teams or groups are formed to meet specific demands. An example of a possible future need will be a faculty who starts up a new course. They will have a need to set up a delivery system for their students tailored to the new course. The world of information sources will have to be examined, someone will have to negotiate, decide and select from the available sources and someone will have to organise the automatic delivery of future materials. Once this task is done the group who set up the system will be disbanded and the maintenance handed over to a small production unit, probably in the computing unit, who will monitor the machines.

Today librarians assist faculty who start up new courses. The difference comes after the course is set up. At this point the libraries main work begins because it is responsible for the delivery of the information. If libraries no longer deliver information then unless they have something else to offer it is unlikely that users will involve them at any stage of development. For the future of

librarianship it is hoped that librarians will not be forgotten and will be amongst the people who work on development teams.

Projects will arise from user demand. They will not be driven by the mission of a library, or from bottom up improvements in efficiencies. The projects come from innovators in the organisation who will probably not be in the library. Professional librarians in this context will act much more like traditional professionals in hospitals, engineering firms or academic institutions. They will possess skills and knowledge of their professions and they will work on teams with other experts to develop systems and projects.

Thus the strategy for change for libraries to meet this new world is to develop skills, structures and techniques that will fit into a future adhocracy. We see this structure as an adjunct to the traditional machine bureaucracy. Finding ways to achieve it and to match the two cultures is going to be an interesting challenge for the current generation of librarians. In the next section we outline some possible steps that libraries can take to meet this challenge.

Project Groups and User Driven Systems

Adhocracies work as small groups without traditional hierarchies of control. They are committed to innovation and to the search for better solutions. They are not driven by the need to standardise outputs and they work as groups of experts drawn together into smoothly functioning teams.

Innovation, non standard outputs and user driven project selection is difficult for a traditional library. People within the system at all levels will have difficulty coping. Libraries have a formal reporting structure and approval mechanism, which is important to maintain in a machine bureaucracy but which is anathema to an adhocracy.

However, in academic institutions there is a structure and a mechanism that fits the model. This is the research project. Here groups of experts come together on a short term basis to work on a particular focused problem. This is similar to the way we see many functions in libraries of the future operating. Hence, one easy way for libraries to get experience with this form of operating is to allow and encourage staff to become involved in appropriate research projects.

For example, if we are faced with the problem of how or whether to introduce a new technology such as Internet, a library could use a **traditional approach** of investigating the technology, surveying users on their needs, trying it out themselves, deciding on how it is to be delivered, organising courses, writing instruction guides and implementing a system.

There are problems with this approach. The delivery of Internet service is primarily a Computing Unit problem. The library is not needed for Internet access and so why should users bother with the library? Even if users involved the library it, the library, is unlikely to have much experience with a new technology and will be in a worse position than a knowledgeable user. Until we get experience with a new technology we have difficulty advising. The traditional approach of developing services that support continued delivery of the same type of information is unlikely to succeed. What we need are methods of gaining experience that can then be reused.

Another approach is the project, research team approach. Here the library actively seeks out partners in the academic side of the organisation who may have an interest in using Internet as part of a research effort or as a main component of research. The library has a professional member of staff actively involved in the project and given time and resources to do this task. The person acts as a normal member of the research team.

Experience gained from such an effort may be used in the reference areas of the library or it may form part of a future education service offered by the library. However, more importantly the member or members of staff will now be competent and available to help on other projects that may wish to utilise the Internet. The critical aspects of this scenario are:

- the librarian is part of an ad hoc research team formed for this problem
- the project ideally should be initiated outside the library - the librarian acts as a professional expert on information delivery to the team.
- the project has a limited life and finishes. The benefit to the library comes from the added expertise of the librarian involved.

While there may be other ways of developing experience in adhocracy structures the research project provides a convenient mechanism for libraries to gain expertise and knowledge. It will help librarians participate in the coming revolution of information delivery.

At the Hong Kong Polytechnic we have taken steps in this direction with professional librarians being given responsibilities for different faculties with the charter to work closely with academics in these areas. Staff are participating in research projects as information experts and we expect this trend to continue.

Conclusions and the Library of the Future

The library of the future may be a schizophrenic organisation. On the one hand the traditional functions of providing materials in their current form will continue. This will require organisational structures based on a machine bureaucracy model. However, this role will become less important in the future. What will become more important will be the electronic delivery of TIPs directly to end users.

If libraries wish to participate in this aspect of information delivery then they will have to adjust and change their organisational structure and their methods of choosing technologies. If they do not participate then this whole aspect of information delivery will bypass the library and will be done directly by users or the service will be provided by a computing unit of the organisation.

To participate libraries must realise that the organisational structure that has served them well may not be appropriate for the new activities. The organisational structures to support the delivery of information directly to end users are likely to be Mintzberg's adhocracy and the development of projects will be Earl's inside-out. To gain experience libraries should find ways of developing their expertise and organisations to support this form of work. This can be done through the institutional mechanism of the research project.

The challenge for libraries is to find ways of grafting a new culture and approach onto a highly successful efficient system. We can learn much from observing trends in other industries and in other areas and we have time to adjust. However if we do not, then libraries will miss the coming revolution of information delivery.

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