Two decades of Hong Kong library automation: reflections and recollections

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Abstract
The library automation environment has undergone drastic changes in the past twenty years. Being a front-line practitioner of systems works in Hong Kong libraries, the author sees numerous waves of technological breakthrough, changing the ways libraries provide services, and in effect, transforming traditional and print-based libraries into digital libraries.
This paper highlights some of the landmark events on library automation that the author experienced in the past 20 years. The Hong Kong Library Association is celebrating its 50th Anniversary. It is timely to recollect these Hong Kong library systems activities, reflect on them and identify important lessons learnt.
By categorizing the key elements in conducting library systems projects, the author attempts to propose a framework, consisting of four areas: technology, learning, organization and leadership, which will act as a checklist for implementing systems projects.

Introduction
As I began to outline this paper for the Conference celebrating the 50th Anniversary of the Hong Kong Library Association, I found myself immersed in unbroken waves of technological breakthrough that leapfrogged one another during my life as a systems librarian spanning three decades.
Technology, particularly in the computing and information arena, is ever changing and advancing. I still remember how excited I was in 1981 when I saw Chinese characters appearing from a system I developed for my final year undergraduate project at the Automatic Control Laboratory of the Mechanical Engineering Department of the University of Hong Kong. The system was written in assembly language and ran on an Intel 8080 microprocessor with 64 kilobyte memory. At that time, Chinese computing was still a new research frontier. The popular Chinese input method Cangjie was only announced as public domain in the following year. And it took three more years for the BIG5 character encoding to appear. The environment is completely different now – no programmer will ever write in assembly language; Intel 8080 can only be seen in museums; BIG5 has been replaced by Unicode; and the keyboard-based input methods are supplemented by other means including hand-writing devices and voice recognition.
By the late 1980s, microcomputers had quietly invaded the workspace of Hong Kong libraries, which led to the phasing out of dumb terminals. Office and productivity software, such as dBASE, Word Perfect and Lotus 1-2-3 were ubiquitous. Library staff, who used to create catalog cards with a huge Chinese character typewriter, started to input Chinese on an IBM PC. And with Microsoft releasing its CD-ROM extensions for DOS, the library world literally entered into a new papyrus revolution.

I joined the library profession in 1987, in the midst of these technological excitements. Being a front-line practitioner of systems works in Hong Kong libraries for more than 20 years, I witness a series of drastic changes to the local library automation environment. A lot of interesting and memorable systems activities triggered the evolution of print-based libraries to digital libraries. I would like to share some of these events, tell a few stories, reflect on them and identify what lessons have been learnt. I would also like to extract from these stories the key elements in library systems activities with an attempt to construct a framework that would help systems librarians and the library management in conducting library systems projects.

CD-ROM Networking

I still remember how jubilant the systems team at the Hong Kong University of Science and Technology (HKUST) Library was when we mounted the first Meridian CD-NET Tower on the campus network in 1991. At that time, CD-ROM networking was a cutting-edge technology and HKUST Library was the pioneer in Hong Kong implementing campus-wide CD-ROM network. Even though we had verbal assurance from the vendor, no one knew for sure whether this new product would work well with the campus’s network environment which used DEC’s Pathworks for DOS.

Implementing new technology involves risks and uncertainties. It requires determined leadership, strong initiatives, courage and sound judgment. There were difficult choices and skepticism during the CD-NET evaluation stage. But with the leadership from the top management, support from the computer center and shrewd judgment from the library systems team, we witnessed this landmark event happening in Hong Kong.

Cutting-edge technology becomes outdated very quickly. We now see networked CD-ROM databases being replaced by Web-based contents; propriety network operating systems such as DECnet and Novell’s Netware gave way to TCP/IP and the Internet; and the popular operating system DOS was superseded by Windows, together with many other options including Mac OS, UNIX, Solaris and Linux.

Technological companies also face vigorous competition and it is common to find them disappearing through mergers and acquisitions. The CD-ROM storage giant Meridian Data was eventually bought by Quantum, while Digital Equipment Corporation (DEC), which was famous in producing high performance computers, was acquired by Compaq, and subsequently by Hewlett-Packard.
The SLS Story
While leadership is a key enabler of library systems implementation, financial and knowledge resources are also essential considerations. I remember how pleased I was when school libraries in Hong Kong were able to carry out library automation in the early and mid-1990s at very low cost by taking advantage of the non-profit SLS (School Library System) software that a voluntary group of librarians and I developed.

In those days, schools in Hong Kong were extremely deficient in computers. You could hardly see IT being utilized in teaching and studying. Commercial integrated library systems from overseas were too expensive for them; and they would not support Chinese anyway. Apart from a few techno experts, teacher librarians at that time generally lacked the skills and training in IT and library automation.

The SLS group and its software turned the dream of automating school libraries into reality. Hong Kong school libraries were able to embark on library automation projects without paying a high fee for software from overseas. The voluntary group of teacher librarians became the coaches to the new comers, preparing them for the changes ahead. The user community created enabled learning and knowledge transfer.

One of the knowledge transfer examples made possible by the SLS software platform was MARC cataloging. At that time, MARC was not popular among Hong Kong school libraries and cataloging practice was not standardized. There was a general misunderstanding that integrated library systems and standard bibliographic format were too complicated to learn and use. With the availability of the MARC cataloging platform, SLS users began to see how efficient and effective it was to follow international standards. This knowledge transfer effort eventually led to the initiation of the Hong Kong School Union Catalog project, enabling the sharing of cataloging records among members.

Library automation involves financial and human resources. A higher price tag usually implies bigger resistance. And as systems works will introduce changes to routine, it is essential to prepare staff through proper training and well planned strategies that enable knowledge transfer.

As an afterword, the Hong Kong Government was a late supporter of information technology in school education. It was only in the late 1990s that the government started providing extra funding to schools for using IT in teaching and learning. Not until then could school libraries get a share from this funding to finance their library automation activities.

Untangling CJK
Apart from the SLS group, another successful community that deserves mentioning is the Hong Kong Innovative Users Group (HKIUG). It is a user group of
INNOPAC/Millennium sites in Hong Kong and Macau. I recall how thrilled I was in 2003 when the vendor was convinced to adopt the CJK (Chinese, Japanese and Korean) resources and standards that the HKIUG developed to resolve some of the stubborn CJK problems caused by the mapping of encodings between EACC/CCCII and Unicode.

This collaborative effort clearly demonstrates the power and importance of collaboration in library systems works. Before the joint effort, individual institutions had numerous dialogs with the vendor, suggesting various approaches to resolve the problem. But these piecemeal efforts were in vain, confirming the fact that vendors tend to be more responsive to collective requests from a group rather than from individual users.

CJK issues have been bothering library systems for a very long time and some of them were quite persistent. In 1988, I overcame a major problem with the relational database model of dBASE to allow for CJK cataloging and OPAC searching at the Fung Ping Shan Library of the University of Hong Kong. I recall how I worked with CCST (the computer center) of HKUST and the INNOPAC vendor in 1992 to extend the BIG5 character set to display simplified Chinese characters. I remember how painful it was to make Chinese CD-ROM databases with either BIG5 or GB encodings co-existing on the HKUST campus network in the 1990s. I remember the engaging project in 2001 to establish a XML schema for name access control with an objective to resolve the different name forms and scripts of Chinese authors via virtual authority repositories. I remember the excitement I felt when I could make DSpace, an open source software, support CJK display and searching during the software evaluation for the HKUST Institutional Repository in 2003; and a similar customization to make the open source software Scriblio handle MARC records in CJK during the software evaluation in 2007 for HKUST’s Next Generation Library Catalog. My memories are still fresh as regards the HKIUG Unicode Task Force’s effort of creating the TSVCC (Traditional, Simplified and Variant Chinese Characters) tables during 2004 and 2006 to enhance CJK searching. And I definitely will not forget the current initiative that the Task Force is working on to enable INNOPAC/Millennium sites in Hong Kong to migrate smoothly to the Unicode Storage Environment.

This list can go on and on and fill up page after page. While I was writing the previous paragraph, I was amused that I actually had handled so many CJK problems. I hate to compare CJK issues with diseases, but I am repeatedly called upon as a CJK doctor by colleagues and others, including system vendors, to help diagnose and address systems-related CJK problems.

One of the lessons I learnt from handling CJK issues is the difficulties of communicating CJK problems to the stakeholders. Developers, service providers, vendors, and even library staff may not fully understand the issues involved in CJK
computing. It is an art, sometimes with frustration, to convey and explain complex CJK issues to them before we can even start exploring for solutions.

**Digital Libraries**

I am glad to be in the midst of the digital libraries evolution. Being a library systems worker for the past 20 years, I see the gradual migration of library services and content from a manual and print-based environment to a predominantly electronic one.

This evolution, if not revolution, was triggered by the availability of the Internet and the World Wide Web (WWW) to the general public in the early half of 1990s. The Internet enables applications to be run across interoperable networks and the World Wide Web allows people to make digital contents widely accessible on the networks. Libraries benefit from these technological breakthroughs and are able to provide services and content on the network for seamless access by their patrons at any time beyond the physical walls of library buildings.

Before the digital libraries evolution, libraries were only able to provide limited electronic resources such as CD-ROM databases and restricted online services such as OPAC terminals and automated circulation. The WWW has transformed the landscape and the ways libraries provide services.

In addition to printed library materials, libraries now have to provide access to electronic resources while e-journals and e-books are irreversibly taking over the publishing territory. Manual services such as interlibrary loan are replaced by electronic document delivery. And mediated online searching found a new life in end-user searching and resource discovery, with ever increasing capability and capacity. Nowadays, most of the library services can be conducted online via a Web browser.

The popularization of the Internet and IT knowledge has enabled not only large libraries but also small ones to transform into digital libraries. For example, most of the school libraries in Hong Kong nowadays have a Web-based library catalog. It is also not surprising to find small libraries engaging in digital library projects. The TWGHs Chen Zao Men College Library, for instance, began testing the open source software DSpace for digitizing its school archives more than two years ago – a project initiated and conducted by the teacher librarian at that school, together with whole-hearted support from the school management.

Before the WWW era, many libraries had already begun content digitization to convert their special collections from print to digital format. HKUST Library began its digitization journey in 1993, engaging in a project to build a Course Reserve imaging system on a DECstation 5240 server with Windows 3.1 clients simulating X-Window display. Experience gained through this project as well as the subsequent ones enabled us to make a critical decision in 1998 regarding what document format to base on for the upcoming digitization projects for the HKUST Theses and University
Archives. The decision was to adopt the emerging PDF (Portable Document Format) standard by Adobe. It was a brave bet at that time when PDF was a newcomer as opposed to the then popular TIFF and Postscript formats. The fact that PDF is now the de facto standard for document on the Web demonstrates that we did make a correct decision. The capability for making sound technological judgment is indeed essential for successful library systems projects.

Open, Open and Open

HKUST Library advocates openness. The Library has been adopting an open door policy since its beginning in 1991, allowing anyone in the community to freely enter the Library and use the library materials within the building. While the open door concept has nothing to do with systems works, there are three other open concepts that have significant implications for the systems team at HKUST Library. They are Open Access, Open Source and Open Platform.

Open Access refers to the movement that promotes free and unrestricted access to scholarly output and research literature. HKUST Library was the early adopter of the Open Access concept and its decision in late 2002 to build the Institutional Repository (IR) for HKUST’s scholarly output signifies the beginning of the Open Access movement in Hong Kong.

The first thing the systems team had to settle on for the creation of the IR was the software. System evaluation and selection are routine but significant systems activities. Inappropriate decision may result in the failure of the project with financial and time implications. With luck, the selection of the software for our repository was relatively straight-forward. It was a quick decision. As the concept of Open Access and IR were quite new in those days, there were not many choices in the market. In addition, the Library decided to launch the repository in a bottom-up approach and there was no special funding for this project. We therefore by default ruled out commercial products and lay our bet on open source software.

Open source software does not simply mean free-of-charge. It has flexibility for local customization too. As the users have access to the source codes, they are able to customize the software, enhance it with new features and contribute additions or changes to the user communities. We finally selected the emerging open source software DSpace, made some significant customizations to it and made a head start for our project.

There have been hesitations from libraries to adopt open source software, even for those well developed applications that have a huge user base. The worry originates from the need of a relatively big investment on local systems resources to maintain and support the software. While this is not always true, HKUST Library has been lucky to have a talented systems team with strong programming and software development skills. In addition to adopting quite a number of open source software, we are even able to produce open source software ourselves and have a Shared
Software Pool Website to make our programming effort available for downloading by others. We believe that libraries which develop non-commercial software tools that prove useful to other libraries should make their work available to the library community at large. This indeed echoes the spirit of shared cataloging that we librarians have been actively engaging in for the past 40 years.

Another open concept that has been around for long time but is becoming more reachable is Open Platform. This is an ideal architecture where all functionalities and services of a system are exposed in a standard way for use by users or third-party programs. I remember how excited I was when I saw my Web service working beautifully in a 2001 experiment to prove the concept of SOAP communication between a prototype name access control repository and a simulated INNOPAC platform. The driving force behind this experiment was a simple need of having INNOPAC to respond to a request for authority metadata from an external program for name access control. I had to simulate the INNOPAC platform for the experiment because there was no way to intrude into INNOPAC to trigger the response. This locked-in problem is indeed one of the issues that the open platform concept attempts to address.

Nowadays, Web services and the open platform architecture are popularly adopted in non-library systems, yet the progress of having these features in integrated library systems is still at snail’s pace. No wonder there is a recent consortium effort known as Open Library Environment led by the academic library community. This group calls for a redesign of the integrated library system that will become more flexible and interoperable. I am eager to see how the next-generation integrated library systems will look like.

While the possibility of having a next-generation integrated library system with open architecture and Web services remains remote, the next-generation library catalog system is at our doorstep. HKUST Library is the first library in Hong Kong implementing such kind of library catalog, featuring Web 2.0 technology, facet browsing, interactive tag clouds, user comments and RSS feeds. And once again, this is made possible by the open source software called Scriblio.

Similar commercial products are available, but their costs are too high for us. Thanks to the advantages of open source software, we were able to launch the new library catalog interface within a very short period of time. And it is amazing that by applying Web content mashup technology, the next-generation catalog interface is able to integrate holdings information from INNOPAC, book cover images and summaries from Amazon and dynamic links to redirect users to external applications such as HKALL and Google Book Search. It can also suggest established name and subject headings as found in the INNOPAC authority database.

Web content mashup will not work well if the target system is open platform unfriendly. It will be interesting to find out how integrated library system vendors react to the Open Library Environment project. Will they open up their platforms to
third-party programs, including those from their competitors? We will have to wait and see.

**The Four Pillars of Library Systems**

Professor Michael Stankosky at George Washington University, founder of the first doctoral program in knowledge management, categorized key elements found in knowledge management activities into four groups, namely Leadership, Organization, Learning and Technology. And he named this framework the Four Pillars of Knowledge Management. While pondering my stories above and summarizing the observations made from these library systems activities, I found this grouping applies perfectly well to the key elements in library systems activities.

**Technology**

Technology is a key enabler of library systems activities, but technology alone is hardly adequate. It is necessary to balance technology with other elements when conducting library systems projects, i.e. to include those related to learning, organization and leadership.

Change and advancements are the norm for information technology. This volatile attribute creates opportunities for systems activities. It also brings problems, including the up keeping of systems workers' IT knowledge; the risk of investing on fads and inappropriate technologies; and the difficulty of conveying cutting-edge technologies to management.

**Learning**

Implementing library systems involves people – the managers, systems workers, vendors and users. It is therefore essential to deal with the learning aspects of these stakeholders.

Knowledge management strategies should be implemented to enable library systems workers to acquire emerging and state-of-the-art technologies. As they are important knowledge asset to the organization, their knowledge and expertise must be well captured and shared with one another within the systems team. It is important to nurture a culture of sharing among co-workers and to foster community spirit via networking with peers from other libraries.

As system activities introduce changes to the organization, it is essential to prepare the users for the changes and keep them informed; to provide sufficient training during and after the implementation; and to collect and respond to user feedbacks.

**Organization**

Organization deals with the operational aspects of the system activities, such as the library functions, processes, content and services that the planned activities target at; the system building and implementation processes; the staffing and the organizational structure of the projects; and the planning and budgeting.

To ensure a successful systems project, implementers need to have a clear understanding on the library functions and processes that they are automating. This
applies to the vendors as well as the systems staff. Based on the nature of the functions and the processes involved, they should give accurate judgment and offer appropriate proposals and actions.

Budgeting is also an essential element for consideration. Usually, a top-down projects that are driven by the top management will have lesser problem on funding and human resources. But, if the project is initiated from bottom-up, measures must be taken to ensure that the proposal is well within the allowed budget, or else efforts must be taken to seek financial and personnel support.

**Leadership**

Successful library systems projects require the full support of the top management. Always involve the management in the whole implementation process. Precise visions and determined leadership are prerequisites for systems projects that involve cutting-edge technology. And for cross-institutional projects, strong leadership from the consortium as well as willingness to collaborate among top management of the participating institutions is the key to success.

Technology, learning, organization and leadership are interconnected. These Four Pillars of Library Systems provide a framework for libraries to conduct systems projects. When implementing systems projects, systems librarians can make use of this framework as a checklist to ensure that elements under these four pillars are in good balance.

**Conclusion**

With an accelerating pace of IT advancement, the coming of the "millennial" users, the sweeping wave of the Web 2.0 revolution, and the changing pattern of resource discovery, libraries are facing far greater challenges than before. Looking back at what we have accomplished in the last two decades has boosted our confidence in turning these challenges into opportunities. By building on our past, we can be sure that Hong Kong libraries are well prepared to move on to the next stage of library automation and to meet the next set of challenges.