Strategic facility management and technology: The Case Study of the University of Calgary

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Abstract

The Campus Infrastructure (CI) Department at the University of Calgary absorbed a 25 per cent reduction in its operating budget in 1995. As a result, it was forced to transform its business processes in order to provide the required level of services to the campus. Through its strategic planning process, it has implemented new technologies that have enabled the Department to meet this challenge.

Keywords: strategic, planning, technology, information, integration, systems

The University of Calgary is located in the city of Calgary, Alberta. It is recognised as one of the major teaching and research institutions in Canada. The main campus has an area of 225 hectares and several satellite campuses are located in other parts of Alberta. The University commenced operation on this site in 1966 and expanded significantly during the 1970s and 1980s. The campus was a major venue for the 1988 Olympic Winter Games and has excellent sports medicine and recreational facilities as a result. The main campus currently has a gross building area of over 790,000 square metres. The University has had an average growth rate in student enrolment of 2.6 per cent per year over the last 20 years and this rate is expected to continue.

RESTRUCTURING IN THE 1990s

The economic downturn in the early 1990s resulted in a major restructuring of many public sector organisations in North America. In Alberta, the provincial government initiated an aggressive deficit elimination and debt reduction plan by reducing programme expenditures by 22 per cent. The University absorbed this reduction in its annual operating grant in the 1994–95 fiscal year. In order to reduce the impact on academic programmes, the budget reductions were more severe in the support departments. As a result, the operating budget for the Corporate Infrastructure (CL) Department was reduced by 25 per cent.

The Department is responsible for the planning, development and management of the physical infrastructure (sites, buildings, utilities and capital assets) for the University. It had traditionally been

Figure 1 Aerial view of the main campus

adequately funded and relied on its manpower to provide the required services to the campus community. It had a hierarchical management structure with multiple levels of managers, supervisors and coordinators. Many of the staff members in these positions had worked at the University for most of their career and were very familiar with the campus facilities. They relied on their knowledge and experience to coordinate services between the various work units and other campus departments. As a result, there was limited development of information systems and facilities records.

The reduction in the operating budget resulted in a major staff downsizing. Many of the managers, supervisors and coordinators were near retirement age and accepted severance packages. A new management team was formed and the remaining staff were grouped into functional work units (eg Telecommunications, Design, etc). Each work unit focused on its day-to-day operational requirements. However, there was minimal coordination between work units and multi-discipline requirements such as renovation projects were not well managed. Tactical and strategic planning was minimal.

EXISTING INFORMATION SYSTEMS

The staff attempted to make better use of facilities records and information systems in order to compensate for the reduction in resources. At that time, the information systems were those shown in Figure 2 and described below.

- A *work order system* was developed as a supplement to the campus financial system in 1978 and ran on the mainframe. Although sophisticated in

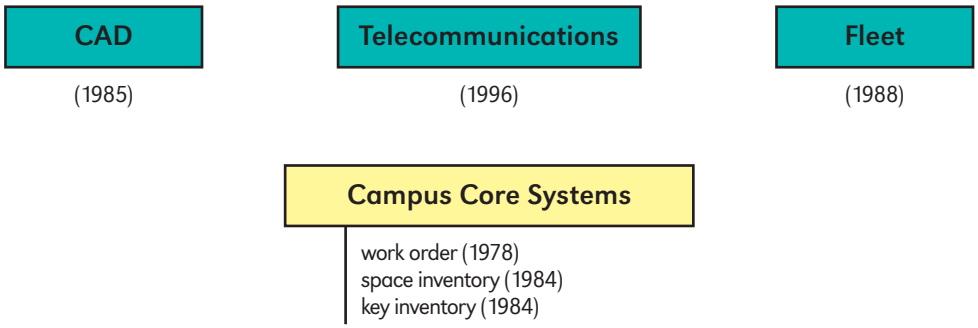

Figure 2 Original information systems

its time, this system was based on old technology. It was a mainly financial system, with minimal facility management (FM) capabilities.

- A *space inventory system* was developed in 1984 and also ran on the mainframe. It was inadequate, as the data were difficult to update and reporting capabilities were limited.
- A *key inventory system* was developed as part of the space inventory program.
- A *computer-assisted design* (CAD) system was implemented in the mid-1980s for the management of design and record drawings. This system ran on a mini-mainframe in the Design unit. However, this CAD software was no longer commonly used in the local building industry. Also, none of the remaining staff were adequately trained to operate this system.
- A *fleet management system* was designed in-house in 1988. This program was not Year 2000 compliant and the cost of its upgrading was not justified.
- A stand-alone work order system was developed in Microsoft Access by the Telecommunications unit in 1996. This system was designed for work management and billing purposes.

Aside from Telecommunications, these systems were of limited value. The work order system required a great deal of administration time to operate, restricted business processes and provided minimal work management capabilities. The space inventory data were not accurate and required reports could not be provided. The CAD system was essentially not being used and the record drawings were inaccurate. As a result, work units began to maintain their own paper records and databases. Other campus departments also began to maintain their own facilities records because accurate information could not be obtained from CI. This resulted in a proliferation of small stand-alone systems for facilities information on campus. It also caused a weakening of the profile of the Department on campus.

THE NEED FOR CHANGE

The CI management recognised the need to transform its business processes and methods of service delivery in order to manage with reduced resources. However, new technologies had to first be implemented to support this change. This technology consisted of two major areas:

- a facilities management information system (FMIS) to provide relevant and

timely information; and
- intelligent building systems, such as 'hard wired' building automation systems, for improved management of facilities with less manpower.

Although intelligent building systems have also been implemented, this paper will focus on the development of the FMIS. At the strategic planning session in 1997 for its three year business plan, the following goal and objectives were set:

> 'To achieve the complete upgrading of the existing facility management information systems and/or implementation of new systems by March 2002.'
>
> '*Objectives:*
> (1) Upgrade existing or implement new systems to provide the information required for strategic management purposes.
> (2) Provide an online service request system for use by the campus community.
> (3) Provide customers with clear information in the billing process.
> (4) Where needed, integrate the FMIS with other campus systems.
> (5) Provide access to the system by CI staff and other campus users.

At that time, this goal was considered to be unrealistic by most staff members. However, as the economy strengthened and the provincial financial situation improved, more resources became available for system development and the project proceeded. The visionary setting of this goal was the catalyst for this project.

FMIS BUSINESS PLAN

One of the performance indicators for this goal was the completion of a business plan for the development of the integrated system. The five-year project commenced in the spring of 1997 and focused on the immediate needs in the CAD and existing work order systems. The business plan was then completed in November 1998. Its specific objectives were:

- to define the scope, cost, schedule and impacts of the project;
- to build support in the campus community; and
- to obtain funding approval for the final three years of the project.

These objectives were achieved as the management and staff strengthened their understanding of the project. Also, it helped to create support for the project in the University community and build confidence in the ability of CI to manage it. Specifically, the University was planning to upgrade all of its core business systems with an enterprise resource product. The prevailing thought was that all other system development on campus should be delayed until the core business systems were upgraded. This issue was addressed in the business plan and the FMIS project was allowed to proceed.

The business plan was based on the development of an integrated system rather than individual stand-alone systems. In order to strengthen the understanding of this concept, it included the system model outlined in Figure 3.

The major components of the FMIS were:

- a *computer-aided facility management* (CAFM) *system* for space management. Unlike the existing database-only system, these space inventory data would be linked to CAD floor plans to provide analysis and reports in a data or graphical format;
- a *computerised maintenance management*

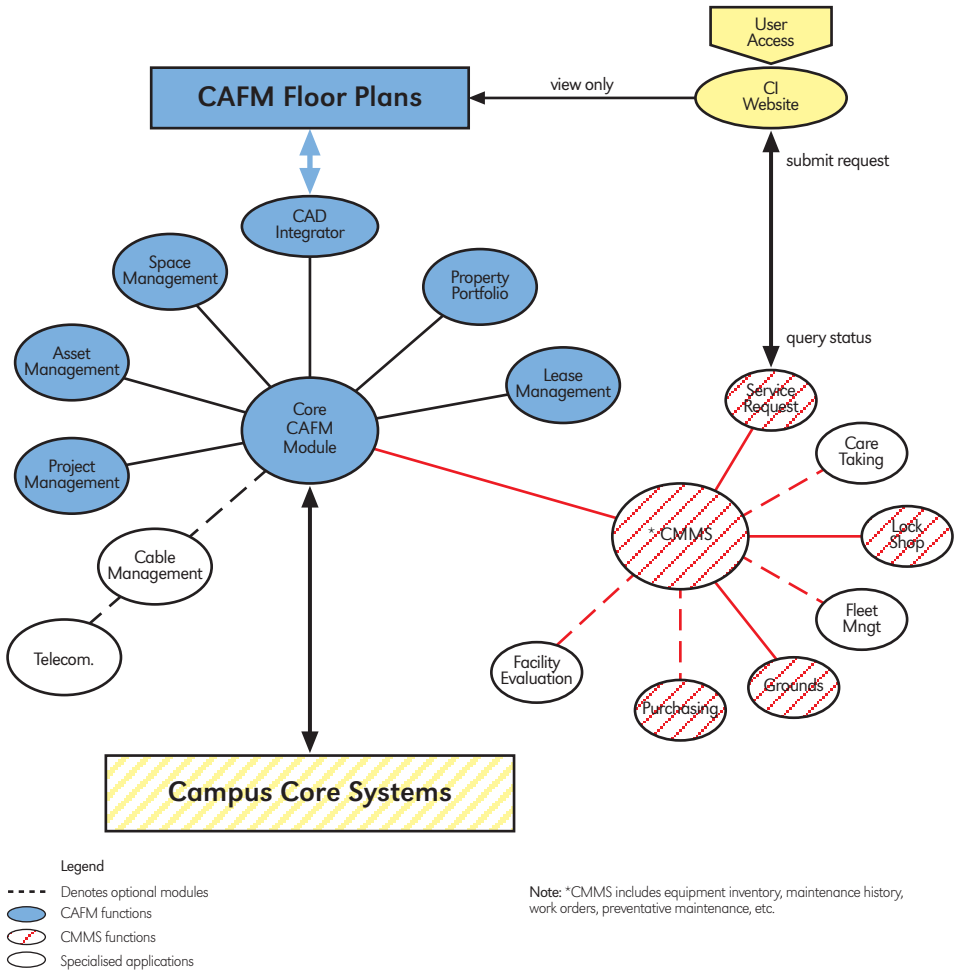

Figure 3 Initial system model

system (CMMS) which would be integrated with the CAFM system;

- *other specialised applications*, which would be optional modules of the CAFM— CMMS, or third-party products that would be interfaced to these systems;
- *an interface* to the campus core business systems;
- a *website* for CI with a link for view only access to selected drawings;
- a *service request system* (SRS) integrated with the CMMS. The SRS would be web-based so customers could submit requests and perform online status queries.

This conceptual system model was subsequently revised in the autumn of 1999 to conform to the network diagram developed by the Department, shown in Figure 4.

This system model included:

- the *campus intranet* (wide area network) and the local area network in the Department;
- an *electronic document management system* (EDMS) for facility records management;
- recognition that the *facility evaluation program* (FEP) for tracking capital renewal and deferred maintenance

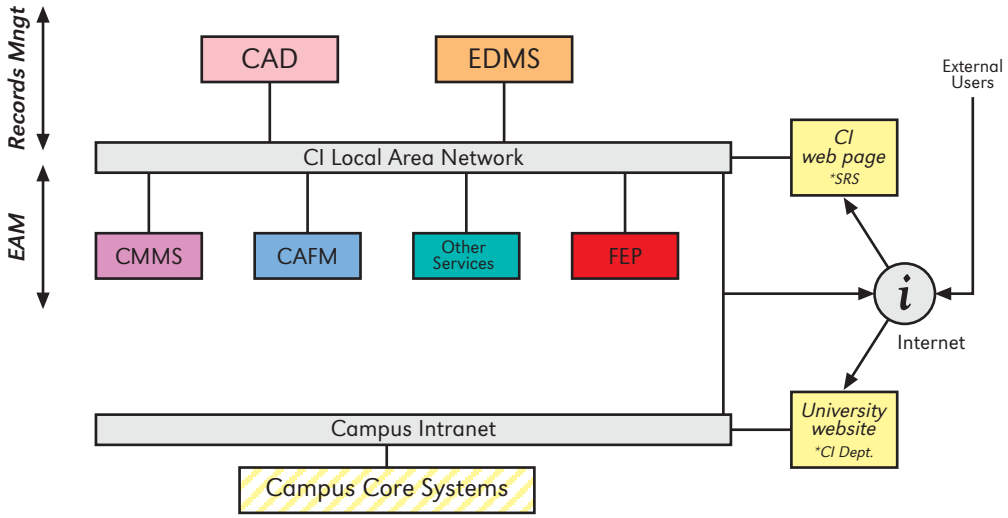

Figure 4 Revised model

requirements was a major system for strategic planning purposes;

- *web-based access* via the University website or the CI web page;
- the *grouping* of the component systems into two major areas: the CAD and EDMS mainly used for management of records information created in the project design stage; and the CMMS, CAFM, FEP and other systems, mainly used for enterprise asset management (EAM) of the facilities once they are occupied; and
- the FMIS comprises the records management and EAML systems, plus the web-based access and links to core business systems.

FMIS DEVELOPMENT

The five-year project commenced in the 1997–98 fiscal year and was scheduled for completion at the end of the 2001–02 fiscal year. The implementation of the component systems has proceeded as follows.

1997–98

- Commenced development of the local area network. It has been continuously upgraded and currently consists of six servers, over 200 desktop computers, network management software and automated backup systems. Most of the component systems operate with an Oracle database.
- Completed a review of the CAD drawing system and developed a plan for its upgrading. AutoCAD software was purchased and existing legacy drawing files were translated into this format. New CAD standards were prepared so that record drawings and CAFM floor plans could be created electronically from the as-built drawing files.

1998–99

- Scanned paper copies of project specifications into an electronic format.
- Scanned hard copies of as-built and record drawings into an electronic format.

- Established a standard for the completion of all future project specifications in accordance with the National Master Specifications.
- Implemented an interim solution to phase out the existing work order system in some work units. This solution consisted of revising business processes and developing supplementary applications for interim use.
- Published the first version of the CI web page.
- Developed a new customised fleet management program in Microsoft Access and imported legacy data into it.
- Developed customised programs for tracking costs on major capital projects and for status reporting on minor projects. These systems were both developed in Microsoft Access.

1999–2000

- Implemented an EDMS using Kruse Control software to provide view-only access to CAD drawings by multiple users on the local area network.
- Completed a needs assessment and request for proposal for an integrated CAFM—CMMS system. Archibus software was selected for this application.
- Installed the Archibus software for the CAFM system.
- Purchased RECAPP software from Physical Planning Technologies for the facility evaluation program and completed a 'cursory audit' of approximately one-third of campus buildings. These data were then extrapolated to estimate capital renewal needs for the entire campus.

2000–2001

- Identified the relevant legacy data in the original room inventory system and imported them into the CAFM system; field verified and revised the existing floor plans and room inventory; linked the data for over 22,000 rooms to the floor plans.
- Purchased and installed a manpower planning and scheduling system from Applied Data Systems for the Caretaking unit.
- Purchased and began implementation of the Archibus CMMS. This included the bar coding of approximately 8,500 equipment assets located in campus buildings.
- Performed a detailed audit of campus facilities for the facility evaluation program in conjunction with the completion of the CMMS asset inventory.
- Established a Customer Service Centre and implemented a temporary web based SRS developed in Microsoft Access for its initial operation.
- Published a new CI web page with a link to the SRS.
- Purchased Active Project software from Framework Technologies for web-based project collaboration and created websites for two capital projects.

2001–2002

- Implemented the new CMMS.
- Phased out the original work order system in all but one work unit.
- Implemented a new web-based SRS using FM Studio software.
- Developed an interface between CMMS work orders and the campus core financial systems. The work order design included a financial coding sub system to allow cost reporting by building, capitalisation of expenditures and billing of cost—recoverable services.

- Implemented a new work order system for Telecommunications using the Archibus CMMS software.
- Developed portals to provide improved user access to the CMMS.
- Decided to purchase the key management module from Archibus to replace the original key inventory system.
- Completed an analysis of new project management software for managing major and minor capital projects. A final decision has not been made on this product.
- Tested wireless personal digital assistant devices for use with the SRS and work orders.
- Established preliminary standards and obtained maintenance manuals for a new building in an electronic rather than a paper format, on an experimental basis.
- Completed an evaluation of the current and optimal level of development of each FMIS component system. This evaluation provided a benchmark to measure progress in the future development of component systems.
- Completed a review of records management requirements. Recommendations were provided for the future storage of records in an electronic format using a new integrated EDMS and records management application (RMA). All electronic documents generated in the design of projects would be accessed through the EDMS. All documents that must be retained for record purposes would be stored in the RMA.

Current FMIS model

The FMIS model is regularly revised to reflect ongoing system development. The current version of the model is set out in Figure 5.

SYSTEM INTEGRATION

The integration of component systems has been an ongoing requirement for FMIS development. The Oracle database was selected and installed on a separate server so that a common database for all assets could be created for shared use by the various applications. Whenever possible, data are shared and are not duplicated. The best example of this is the location data (site, building, floor, room), managed in the CAFM system and shared by the SRS, CMMS, Caretaking and Telecommunications systems. This reduces data entry and allows all location-based information to be validated upon entry.

The database integration has also provided opportunities for enhanced reporting capabilities. The Active Project software is used to access data from both the FMIS and the data warehouse for campus core systems. It has produced financial reports that were previously not available. This system is referred to as the *Campus Infrastructure Management Information System* (CIMIS).

However, this integration also results in more complexities in system development, such as:

- Although compatible third-party products could be considered for new component systems, the preferred solution is to use a module of the CAFM–CMMS software product. Therefore, the availability and suitability of optional modules must be considered when initially selecting the CAFM–CMMS software. The quality of the technical support must also be evaluated, as the organisation will

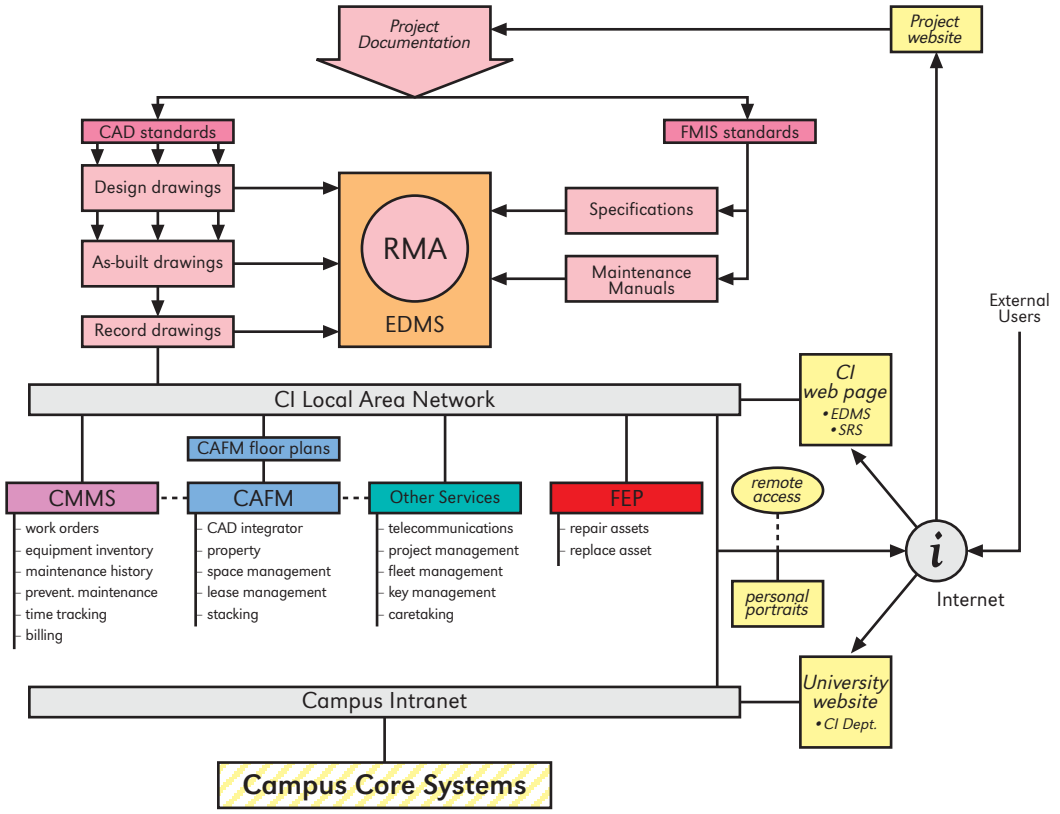

Figure 5 Current FMIS model

become increasingly reliant on the software developer.

- The validation of data upon entry can significantly slow the system operation. When these problems occur, measures must be taken to improve performance. For example, once entered and validated, the requestor contact information in the SRS can be saved for future requests.
- For an organisation with a large room inventory and ongoing renovations, it is very difficult to keep the room inventory database up to date. Therefore, a new room number may not be validated upon entry if this change has not been made in the database. This situation must be considered in the system design.
- Standards must be developed for all FMIS data and strictly enforced. In particular, the space taxonomy standards for room names, classifications and coding must be used on a consistent basis.
- In order to provide department-wide analysis and integrated reports, the required data must be captured in the component systems. This results in more data entry by system operators. In some cases, data must be entered that are not required by that particular work unit.

STRATEGIC PLANNING

The FMIS project was initiated through the setting of a goal during the strategic planning process. Now that the project is near completion, the FMIS capabilities have become an enabling factor in setting

new strategic goals and objectives. The following goals in the current three-year business plan illustrate this relationship.

(1) *Review the organisation structure to create a more effective service delivery model.* A zone management model was initiated by establishing customer service coordinators in five zones on campus. CMMS work orders are location-coded into these zones. Each zone manager has online access to all current work orders and historical records for the relevant zone.

(2) *Establish a benchmarking programme for operating-cost comparisons to other organisations.* The CIMIS is used to produce operating cost reports for each building. These consist of operating and maintenance costs and capital renewal requirements. Computer-calculated floor areas for each building are derived from the CAFM system for use in cost-per-square-metre calculations.

(3) *Complete a facility condition evaluation to assess accurately the backlog of deferred maintenance and capital renewal requirements.* The cursory audit for the FEP system provided an analysis of capital renewal needs for each building. The completion of the detailed audit provided evaluations to the asset level. This will allow the shared database for each asset to be continuously updated when any maintenance or renewal work is completed. It will result in 'evergreen asset data' that will eliminate the need to perform ongoing building condition evaluations.

(4) *Implement a customer service centre as a single point of contact for customers.* The SRS has enabled the customer service centre to manage effectively an average of 2,500 service requests per month. Customers now submit web-based requests and perform their own online status queries.

(5) *Improve the delivery of caretaking services.* The custodial manpower planning and scheduling system calculates the number of persons required per building for caretaking purposes. This calculation is based on the floor finishes, from the room inventory database; floor areas, from the CAFM system; and task time standards.

(6) *Investigate alternative methods of delivering fleet management services.* The fleet management system provides accurate information (eg age, book value, maintenance history, gasoline consumption, etc) for each vehicle. This has allowed a comparison of the cost of in-house and external service providers to be completed.

(7) *Undertake a review of building and environmental regulations to determine if the University is at an adequate level of compliance.* These requirements were assessed during the detailed audit of assets and recorded in the FEP.

(8) *Complete a campus community plan that will position the University for long-term growth.* The CAD record drawings for campus facilities and the CAFM system for space analysis were used extensively in the completion of this master plan. The capital renewal needs identified in the FEP were also used in long term planning for some buildings.

(9) *Develop a comprehensive space management process to track and evaluate the use and utilisation of space.* More sophisticated space planning and analysis can be completed with the CAFM system.

(10) *Improve capital project status and cost reporting.* The CIMIS is providing reports on individual projects and

summaries for all projects. This information will eventually be available to stakeholders via the CI web page.

(11) *Improve communications with stakeholders and access to information.* The CI web page provides information on services available and how best to access them. The project collaboration system provides effective web-based communication with stakeholders on major projects.

(12) *Develop a central storage facility for campus-wide use.* The CAFM system produced a report on all storage space on campus. These data were used in the completion of a study that supported the need for a central storage facility.

FUTURE SYSTEM DEVELOPMENT

CI updates its three-year business plan each year and continues to set goals for the ongoing development of the FMIS. Plans for future system development include:

- A *Facilities Information Centre* is being established to manage the FMIS. This group will ensure that the system is developed on an integrated basis.
- An '*integrated asset database view*' will be developed for viewing of all required information on assets. Currently, information on an asset must be obtained through the application that was used to create the data: for example, capital renewal requirements must be obtained from the FEP Upon completion of this initiative, a summary of all information on an asset (technical, financial, warranties, maintenance histories, etc) can be viewed through a single screen.
- A '*sustainable building design*' process is being implemented to strengthen the budgeting and life-cycle costing of facilities. The Uniformat II classification system developed by the General Services Administration in the United States has been adopted as a standard. This coding system will be used to provide consistent identification of all building components, systems and assets from the initial budgeting to the final disposal stages of their life cycle.
- The CIMIS will continue to be developed to provide analysis and reports on *integrated information*. For example, reports with all required information on staff for management purposes are now being provided.

CONCLUSIONS

Although this technology was not new to the province, this project was unique because of its size and degree of integra tion. For organisations that may be considering a similar initiative, some lessons learned in this project are:

(1) A goal and objectives should be set forthe project.

(2) Economic conditions and other factors can fluctuate rapidly. It is, therefore, very important that senior manage-ment continuously support the project.

(3) A system model should be developed for the project. In this case, the system model enabled staff to visualise the benefits of integration.

(4) The preparation of the business plan was important. It strengthened the understanding of the need for the project by CI staff and helped to build support throughout the University.

(5) The economic benefits of this type of project are very difficult to quantify. The department never expected to

achieve a 25 per cent cost saving with the FMIS only, as re-engineering, reassignment of responsibilities and outsourcing were also required to manage the budget reduction. The implementation of this technology was seen as an enabler for the department to provide facilities management services on a sustainable basis.

(6) The development and ongoing operation of the FMIS should be managed by a central group. This project was initially handled by one group but it was unable to meet the demand for services as the system grew in size. In the third year, the development of some component systems was assigned to other work units and external consultants with varying degrees of success.

(7) A budget should be prepared and actual costs should be tracked in accordance with good project management procedures. In the business plan, a budget cost of $750,000 (Canadian funds) was estimated for the final three years of the project. This estimate included the purchase of software, training, technical support services, hardware and temporary staff for database development. However, the decentralisation of system development in the third year weakened cost reporting. Therefore, a final cost summary has not been completed.

(8) The implementation of new technology often results in significant changes to business processes and organisational structure. A change management process should also be implemented to reduce the impact on staff.

SUMMARY

The final year of this project was completed in March 2002. Overall, the project has been a success and the goal set in 1997—98 has been achieved. This project has strengthened the CI profile on campus and the University is now acknowledged as a leader in facility management in Alberta. With the ongoing development of the FMIS, the University will strengthen this leadership role in the future.

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