Advantage U of S

Foundational Document for Information and Communications Technology at the University of Saskatchewan

June 2003

Executive Summary

Information and Communications Technology (ICT) has become tightly woven into the fabric of the contemporary university. The quality of our ICT environment affects the way we teach and the way we learn, the way we manage our business processes and the way we interact with both our customers and our colleagues. The quality of our ICT environment also affects our ability to compete successfully for faculty, staff and students. For these reasons ICT must feature prominently in our institutional planning. Investing in ICT is critical if the University is to attain the strategic goals articulated by the President in his **Strategic Directions** paper.

The University has increased its investment in ICT for solid reasons: to enhance the student experience, to provide faculty and staff with the facilities and services they require to be successful, and to introduce new services and new functionality. But ad hoc, uncoordinated development will not get us where we need to be. Individual needs must be addressed in an integrated context, and so the ICT Foundational Document is an important element of Integrated Planning.

This document addresses four major areas:

- ICT for teaching, learning and research
- Business support systems
- Infrastructure enhancement
- ICT governance

Several important themes emerge. Central among these is the articulation of our federated approach to ICT — recognizing that some responsibilities are properly vested in individual units while others are more appropriately addressed centrally, and that we must strike the appropriate balance between centralization and distribution. Within this approach we stress the need to provide reliable, secure, flexible and cost-effective infrastructure (hardware, software and support) to meet our wide-ranging demands, with an institution-wide perspective.

The significant ICT investments we have made in recent years, both centrally and in individual units (colleges, administrative units), must shape our future plans if we are to reap the full benefit from them. Some key projects are discussed in this document, both as examples of these investments and as design points for future planning. As individual units develop their plans, they need to pay careful attention to ICT implications and costs. It is important to recognize both local and central costs of all sorts (hardware, software, renewal, support), and to acknowledge the need for both local and central investments. Desktop computers, for example, although presently a local cost, are of limited value without connections to central servers through a campus network capable of handling the volume and variety of traffic. Strategic central investments such as the SI project and a campus-wide portal will not return their full value unless individual units are prepared to contribute to coordinated planning and to align their processes and practices to decisions made centrally.

Any plan is, of course, a living thing that must be adjusted continually as needs and circumstances change. Because the technology changes so rapidly, this is especially true in a plan for ICT. This document represents but the first in an ongoing series.

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ad-van-tage

n. a favouring circumstance; a favourable occasion, an opportunity.
v. to further, advance, contribute to the progress of; to place advantageously.[1]

1. Introduction

The University of Saskatchewan is committed to remaining a nationally competitive university. This requires ongoing assessment of its plans, its practices, and its priorities. Information and Communications Technology (ICT) has become tightly woven into the fabric of the contemporary university. The quality of our ICT environment affects the way we teach and the way we learn, the way we manage our business processes and the way we interact with our customers. This technology impacts everything we do, affecting both how we do it and the quality of the product. For this reason it must feature prominently in our institutional planning. ICT is an enabler, not just an expense. Investing in ICT will help the University attain its strategic goals. Indeed, if we don't invest in ICT it is questionable whether we can achieve these goals. The complex issues we face have been discussed widely and extensively in committees, in colleges, in administrative units, and among faculty and students. Several external reviews have been commissioned, and there have been numerous internal assessments. We all agree that providing a high quality contemporary ICT environment must be accorded high priority.

Broadly speaking, ICT refers to the hardware, software and networking infrastructure we use to manage, process and transmit information and provide information-related services. ICT embraces facilities such as desktop computers and peripherals, servers, communications and networking equipment, the systems software required to make it all run, and the applications software that provides the services we require. Any large business has substantial ICT needs and the University of Saskatchewan faces the same challenges as everyone else in trying to meet them. Escalating demands, rapid obsolescence, and the steady barrage of new products all plague administrators who must try to manage a highly unstable process and find the budgetary resources to sustain it.

With an estimated asset value in excess of $60M (roughly 50% of which is in the Colleges) the ICT infrastructure at the University of Saskatchewan already represents a substantial investment. A combination of vision, commitment and resources has resulted in some significant successes: a first class campus computer network, an expanding set of technology-enabled multimedia classrooms, wide-ranging on-line services through the Library, some fine computing facilities to support the needs of our students, and a solid infrastructure for our research requirements. In some critical areas, however, it is clear that we are not where we should be – that we must invest even more to address unmet needs and remove impediments to pressing new developments. At the same time we must be realistic. We have neither the staff nor the fiscal resources to do everything that could be done, and so we must set priorities to move forward in a way that is in keeping with the constraints under which we operate.

[1] Oxford English Dictionary.

Our model for ICT at the U of S is a highly distributed one – both in the way we administer it and in the way we fund it. There are significant advantages to decentralization, but there are also some important concerns. High level planning is extremely difficult and serious disparities can arise among units without strong central coordination. Something so critical to our enterprise must rest on a solid foundation. Since everyone is affected by ICT, every college and administrative unit must engage in the development of ICT plans, both locally and institution-wide, in a manner that integrates ICT planning with planning for all other facets of their operation.

We need to know where we are to plan where to go. In preparing this document, we have drawn on a wealth of experience by reviewing numerous reports (both internal[2] and external[3]), by consulting with key stakeholders, and by listening to the advice of those who have reflected on these issues and have worked to advance the ICT agenda at the University. We have tried to incorporate this experience, the wisdom that has developed from this experience, and the advice that comes from this wisdom into a vision for ICT at the University of Saskatchewan and a plan for achieving that vision. Since circumstances change rapidly in this field neither our vision nor our plan will have a long shelf life. ICT planning must be an on-going activity, and this document should be viewed as but one output of a cyclical exercise.

> "*Effective information technology planning cannot take place in a vacuum. It must be integrated into institutional planning, mission, and goals. At the physical level it must be an integral part of every construction and renovation endeavor. At the operational level it must meet demand for access to IT resources. At the functional level it must serve the institution's community: students, faculty, researchers, administrators, prospective students and employees, alumni, and parents —all those who endeavor to acquire, create, and convey knowledge.*"[4]

2. Goals and Principles

Planning for something so integral to everything we do must be done carefully and effectively. Our vision for ICT at the University of Saskatchewan must be developed collaboratively, and applied

[2] Key internal reports include the 1999 report of the Information Technology Committee of Council (*Recommendations for the Strategic Application of Information Technology at the University of Saskatchewan*, November 1999), the 1999 report of the Student Computing Task Force (Kavanagh *et al*., April 1999), and the 1997 strategic plan for the Department of Computing Services (*Strategic and Effective Application of Information Technology at the University of Saskatchewan*, March 1997).

[3] Most notable among the external reports are the 1997 King Report (Kenneth King, Andrew Bjerring and Russell Vaught, *Information Technology Assessment: the University of Saskatchewan*, November 1997) and the 2000 Stark Report (Wendy Stark, *Information Technology at the University of Saskatchewan: Transition and Implementation Considerations*, March 2000).

[4] Susan J. Foster and David E. Hollowell, "Integrating Technology Planning and Funding at the Institutional Level", in *Information Technology in Higher Education: Assessing its Impact and Planning for the Future* [Katz & Rudy 1999]

universally. ICT planning must be part of the planning framework for every unit, both academic and administrative. It cannot be done by one person, one committee, or one division, and ICT plans cannot be grafted on to unit plans "after the fact", most certainly not by some outside group.

To provide the foundation for ICT planing at the University of Saskatchewan, we offer five goals:

1. *ICT-literate students, faculty and staff.*
   ICT skills are important to the entire University community. All students, undergraduate and graduate, must be given the opportunity to develop the ICT skills that are relevant to their field of study, and to exercise them through the provision of contemporary, cost-effective, accessible and reliable computing facilities. We must also ensure that faculty and staff have the opportunity to develop and use the ICT skills they require to be successful.

2. *An ICT-rich environment for teaching, learning and research.*
   A contemporary university requires ICT to support its practices in all facets of its academic activity. Teaching and learning can be more effective with state-of-the-art instructional technology, and researchers depend on the availability of cutting edge technology in support of a wide range of activities. We must continue to seek the most effective and appropriate means of applying ICT in the instructional processes of the University, at the same time recognizing that traditional instructional methods may well remain the mainstay of University of Saskatchewan teaching for some time, and we must support our researchers with whatever technology they require to be successful.

3. *Contemporary administrative systems to support our business processes.*
   Our business processes must be supported by contemporary administrative systems that embody "best practices" in the area. Effective planning will help us achieve enterprise-wide integration of both our systems and our services.

4. *A wide range of on-line services.*
   Many of our services to and for students, such as registration and advising, can and should be provided on-line, so that those needing to access these services can reach them whenever they need them, from wherever they are. This will increase both the availability and the efficiency of these services, but it is unlikely that it will decrease the cost to provide them.

5. *Effective and reliable ICT infrastructure to meet our institutional requirements.*
   As we become more reliant on ICT in everything we do, we must ensure that the infrastructure is available to address these needs effectively and reliably. We must also ensure that every user has access to the technical support they require when they require it.

Our approach to achieving these goals is shaped by some basic principles, which form the basis of the discussion throughout the ensuing sections.

Our first basic principle is a governance principle – "shared responsibility". Our approach to ICT at the University of Saskatchewan has both centralized and distributed elements, and, in our view, that is how it should be. We believe strongly in a federated model, in which individual units (colleges, departments, or administrative units) have both responsibility and budget to address local needs, and central units such as Information Technology Services (ITS), the Division of Media and Technology (DMT), the Library, and Printing Services provide institution-wide services where it is appropriate and effective for them to do so. Inherent in this approach is a requirement for cooperation and collaboration, rather than competition, but also a requirement for the respective units to develop their own planning and governance mechanisms for ICT.

Our second basic principle is a service principle – "anywhere, anytime availability". We must provide the members of our community (faculty, staff, students) ready access to the resources (information, services, or infrastructure) they require – whenever they need them, from wherever they are. Emerging technologies offer considerable promise, but there are significant implications for our infrastructure.

Our third basic principle is a support principle – "stable finances". For ICT planning (either short-term or long-term) to be effective or meaningful, it must be done in a context of stable and predictable funding. Our current approach to ICT is fraught with problems resulting from our reliance on ad hoc and unpredictable sources of funds – for equipment acquisition, for operations, for renewal, and for staff. We have some good examples (such as the classroom renovation project and the campus computer network) where stable and predictable funding has been critical to success, but we have many examples of trouble that has been created by an opportunistic and reactive approach (such as in our approach to desktop computing). Although we may achieve "random acts of success", we can't expect to make significant progress until we break out of this pattern.

Our fourth basic principle is a collaboration principle – "progress through partnerships". Partnerships can be used to advantage; indeed, with the limited resources we have available we cannot afford to compete with each other in our ICT ventures. To paraphrase an old saying, we work together or we'll die separately. Cooperation is essential. Partnerships can be usefully forged within and between colleges and administrative units, both in setting general directions and on specific projects. We must also actively seek external partnerships – with other universities, with government agencies, and with the private sector. Partnerships must, however, be managed in a coordinated way to ensure that meeting institutional goals is the paramount consideration.

3. ICT Support for Teaching and Learning

"*New technologies … have the potential to widen access to new learners, increase flexibility for 'traditional' students, and improve the quality of teaching by achieving higher levels of learning, such as analysis, synthesis, problem solving, and decision*

> *making. These new technologies can also be used to develop learners' skills in seeking, analyzing, and interpreting information relevant to their subject domain.*"[5]

Teaching and learning is our business. Knowledge is our product. In the knowledge-based world of the twenty-first century, ICT plays a prominent role in teaching and learning – in the classrooms, in the laboratories, and in the general environment. There are many manifestations of ICT's connection to teaching and learning. This section addresses three: student computing, teaching and learning spaces, and distributed learning.

3.1 Student Computing

Access to computing and information resources is a fundamental part of the contemporary student experience. Every student in every discipline must be ICT-literate, both to support his/her learning and to be competitive in the workforce after graduation, and so ICT facilities are essential to our students' university experience.

Through a variety of choices made over the 1990's the University of Saskatchewan developed an unusual model for student computing – unusual in its administration and unusual in its funding. A 1999 study[6] identified a number of serious problems with this model and presented recommendations to address them. After widespread consultation with a great many interested parties, including students, colleges, departments, lab managers, central administrators, and support units, a new model[7] has been introduced. The new model acknowledges that there are "laboratory" elements to what some students need to learn, but reflects a view that student computing cannot be confined to college or department laboratories. ICT must be part of the general environment. Departments and colleges should (and will) continue to provide discipline-specific functionality in laboratories that they control, and the University should (and will) provide complementary general-purpose functionality in general-access spaces. The responsibility for providing facilities and supporting student needs will be shared in a cooperative and synergistic way among departments, colleges and central support units such as ITS, and the respective allocation of resources will reflect their proportional shares of responsibility.

Regardless of their discipline of study, students require ready access to foundation-level services such as e-mail and internet, basic productivity tools such as word processing and spreadsheet, and services such as those offered by the Library, Student and Enrolment Services, and various business units. A single, secure system-wide id and password should allow a student to access all of our ICT services, and there should be a common "look and feel" to these interactions. Also emerging is a growing need to support "mobile computing" – so that students can access campus facilities and services from their personal devices (laptops, notebooks, palmtops) through docking stations or wireless network access points. Students should be able to access basic software, their files, e-mail, courseware and general Internet services from their personal computers, in a manner

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[5] A.W. (Tony) Bates, *Managing Technological Change: Strategies for College and University Leaders*, Jossey-Bass, 2000.
[6] Kavanagh *et al.*, *Final Report, Task Force on Student Computing*, April 1999.
[7] Bunt, *A New Model for Student Computing at the U of S*, Working paper, June 2001.

that is indistinguishable from access from a campus-based lab. Increasingly access to ICT resources is a fundamental component of the contemporary student experience and we must continue to work to find creative ways to provide it. There should be a network connection in every room in residence, for example – something that many of our peer institutions now provide. This will simultaneously provide service to these students and ease the pressure on our laboratories.

Discipline-specific services must also be provided – facilities (space and hardware), support, training and software required for specific courses and/or academic programs. Students in computer science, engineering, art, music, languages, geography, and geology require specialized services now, and students in many other fields of study will have similar needs shortly. Specialized services are most effectively provided (and managed) by college or departmental facilities, and so we must not remove colleges and departments from the student computing business entirely. Indeed it is vital that they continue to be engaged. We must develop and deploy a standard model for facility operation and renewal, and build the required costs into unit budgets. Capital budgets must not be used to support ongoing costs.

We have made significant progress in student computing, with the help of substantial and broad-based support from the community. New public access facilities[8] have been constructed in the Library (the Learning Commons), in the Arts Building (Arts 110), and in USSU space (Browsers, Place Riel Tunnel). That these projects were conceived, developed and funded as partnerships is a clear sign of the community's willingness and ability to address these needs collaboratively. New facilities are also being put in place to support mobile users and to improve service to off-campus users, and we are working on a business plan for networking the residences. College-based computer fees have been eliminated and the revenues that previously accrued from these fees have been built into base budgets. New funding provided for student computing in the University's 2002/03 operating budget is being used to provide increased support levels and further expansion of service, and a new Program Manager for Student Computing has been hired to provide central coordination, direction and leadership.

In summary, student computing must be a priority of the University, both organizationally and fiscally. ICT is vitally important to our students and the University must be determined to develop and sustain an affordable, functional and effective computing environment for them. The approach we used up to now resulted in uneven delivery and created "haves" and "have-nots". This "digital divide" will be overcome only when we provide the means for every student, regardless of discipline, to have access to ICT resources and services. The challenges are four-fold: to provide facilities (equipment and space), to secure the funding required both to develop and renew facilities and to operate them, to provide the necessary support to users (including remedial training where required), and to develop an effective management structure. A federated approach, with shared roles and responsibilities, can eliminate duplication of effort, maximize service and support to students, and minimize costs. While we must have strong central leadership, we must continue to recognize the shared roles between central units and the colleges.

[8] We now have more than 1200 student seats across the campus: 850 in discipline-specific facilities operated by the colleges, and 350 in general access areas.

Adequate and sustained budget resources must be assigned to those units involved in supporting instructional computing activity in proportion to their share of the overall responsibility. Renewal budgets must be developed for ICT infrastructure in colleges and administrative units. Issues of governance must also be addressed. Where colleges do not have ICT or computer committees, these should be created, and an organizational mechanism for inter-college communication and cooperation should be established. Student input is very important and so students must be active participants in these bodies. Our vision for the ICT aspects of the student experience draws together our need to provide on-line services to and for students (in line with recommendations arising from the Si! project, the portal project, and the ROSS project) and our efforts to provide facilities for students to support (indeed, enhance) their experience at the University.

3.2 Teaching and Learning Spaces

The contemporary classroom is technology-empowered. By giving faculty access to state-of-the-art media technology in teaching spaces, we make it possible for them to enrich their classes by accessing a seemingly limitless array of information sources, or by importing relevant aspects of their research directly from their desktop to the classroom. By extending the technology of content delivery past the traditional chalk face we provide richer learning opportunities for our students.

A five-year plan was launched in 1998 to renovate our teaching spaces to contemporary media standards. The plan, as originally conceived, addressed the renewal of 60 spaces, including 23 lecture theatres, with leading-edge instructional support technology. The planning report also recommended that in parallel with capital funds to renew the spaces physically, is a requirement for ongoing operational funding in the form of technical maintenance, operating/support personnel, training, and ongoing refreshment of technologies as they age. Unfortunately funding shortfalls every year have meant that we have not been able to carry out the capital renovations at the pace we require and we are now having to upgrade some of the technologies that were installed five years ago. Although the capitalization of the project has not met expectations, at least it has been ongoing and predictable. The issue of operational support, however, has not been properly or adequately addressed.

By September 2003 we will have completed the renovation of 15 lecture theatres under the able stewardship of the Division of Media and Technology (DMT). Each renovated lecture theatre contains a standardized multimedia console from which the instructor can access a touch screen panel controlling a wide variety of multimedia technologies, including a computer connected to the campus network, a VCR/DVD player, and a document camera, all feeding to a high-quality video data projection system and a state-of-the-art audio system including wireless microphones and technology for the hearing impaired. In addition to the renovations of the theatres, 23 fully equipped mobile carts are available for dispersal to other teaching spaces throughout the campus. Feedback from students and faculty who have used these new facilities has been extremely positive, and additional requests continue to expand the list of spaces waiting to be renewed.

The campus-wide positive endorsement of this initiative is highly gratifying, but its success has introduced even more competition for funds and placed additional stress on already limited

budgets–not only capital budgets for acquisition and installation, but also operating budgets to maintain and operate the installed infrastructure. Maintenance costs are significant. As just one example, the life of a video data projector bulb averages around 1,000 hours and the replacement cost of a bulb is approximately $800. With a current inventory of 150 data projectors (a pool that is increasing rapidly) these costs can be substantial, and we need to find a balance between centralized and decentralized responsibility for how we support these resources. The importance of this project is undeniable. It is clear not only that it must continue but also that additional funding must be provided.

The classroom renovation project also illustrates the value of an effective plan. Five years of capital equipment funding was secured for this plan, and even though the allocation has fallen short of the request, the predictability of funding has been important to the success of this initiative. Progress against the plan is monitored continuously through a feedback process. This approach can, and should, be applied more broadly.

As the definition of a contemporary (technology-empowered) learning space continues to expand, we must continue to explore new opportunities. Wireless access technology, for example, now allows students to access ICT resources from the classroom and public spaces, and presents a new spectrum of instructional opportunities. We have begun to explore the potential of this technology with the installation of wireless technology in a variety of places, ranging from the Library to classrooms to study spaces to the College of Law's Moot Court. We are currently experiencing a rapid expansion in the regular use of videoconferencing for teaching purposes in various Colleges, including Law, Education, Pharmacy, WCVM, Agriculture, Arts and Science and Medicine. The Colleges of Law, Education, Arts and Science and the WCVM have installed videoconferencing facilities, while other colleges and departments access facilities and technical support through DMT. We are also incorporating multimedia technology into the renovations of other teaching spaces. State of the art instructional laboratories have been developed, for example, in Computer Science, Arts and Science and Commerce.

Teaching and learning are not limited to the classroom or laboratory. ICT opens new doors by presenting new paradigms and new approaches (for asynchronous learning, for example), and we must ensure that we have the technology base in place for such initiatives to develop and to flourish. We can challenge our students to extend their own learning boundaries by making new technology available to them. The Province's Technology Enhanced Learning (TEL) initiative can provide opportunities for us to explore new paradigms in collaboration with our provincial post-secondary partners. We can also benefit from the experience of peer institutions through national initiatives such as COHERE[9], an eight University consortium for collaborations in on-line learning in which we participate. These opportunities are explored more fully in the next section.

3.3 Distributed Learning

In the new millennium teaching spaces are virtual as well as physical. Advances in distributed and asynchronous learning promise to enrich the learning experience for both on-campus and off-

[9] Collaboration for Online Higher Education and Research (http://www.cohere.ca/).

campus students by extending the traditional classroom. With active research programs in this area and good practical experience, our community readily embraces on-line learning. Indeed the University of Saskatchewan is well positioned to make significant contributions to on-line learning by moving even more research results into practice. Far from a threat to our traditional ways of doing things, on-line learning can complement face-to-face approaches and provide added value to students.

Interest in distributed learning is growing throughout the University. Colleges are actively developing on-line versions of their courses (or some form of on-line support) and several Colleges are considering requiring that every one of their students include an on-line course as part of his/her program of study. We must be able to support this demand.

Two new initiatives provide us with opportunity and means to make significant progress. With its Technology Enhanced Learning (TEL) program[10] and the Campus Saskatchewan partnership[11], the Province has signaled its desire to move forward aggressively. TEL is a collaborative initiative of the post-secondary sector and funding is provided as part of the base budget of Saskatchewan Learning[12]. The TEL program will enable us to increase the U of S presence in the expanding world of on-line learning by providing resources to develop selected courses for on-line delivery and the expertise we need to support their delivery. As a campus we already had substantial experience in this area, and highly skilled resource providers on which to draw; the special funding available through TEL will allow us to progress more quickly. The enthusiastic response from our academic community to our calls for TEL projects indicates that interest is substantial and broad-based. The TEL program has been in place since 2000 and the first U of S courses came on-stream in the fall of 2002. Faculty subject matter experts are now working collaboratively with instructional designers from the Extension Division and technical experts from ITS and DMT to develop on-line versions of more than 60 of our courses.

We also partner with seven other universities across the country in COHERE (Collaboration for Online Higher Education and Research). COHERE provides valuable opportunities for collaboration and interchange with other universities in this rapidly developing field, and access to funding sources to support research projects in this area.

It is important that we embrace initiatives such as these, and that we encourage widespread campus participation. The benefits are many. Students, both on-campus and off-campus, will benefit from an expanded range of delivery options. Faculty and staff will be provided exciting opportunities to work with new educational technologies and to put research results into practice. The Province will benefit through an expanded presence in this highly visible space. At the same time, we must ensure that our institutional goals remain foremost in our minds as we move forward.

[10] http://www.usask.ca/vpacademic/tel
[11] http://www.campussaskatchewan.ca
[12] formerly the Department of Post-Secondary Education and Skills Training (PSEST).

The new Centre for Distributed Learning being proposed by Extension could focus our research activity in distributed learning at the University of Saskatchewan. In the near term, the Centre could provide a research framework to help inform the development and delivery of TEL courses by Colleges and Departments. In collaboration with the Colleges, the Centre could also help advance these on-line initiatives as a testbed for new research. The Centre would also be well positioned to provide linkages to other research in technology-enhanced learning through its membership in external partnerships such as COHERE.

4. Supporting Research

ICT and research have had a long and distinguished association. Historically, the first computers were research machines and research continues to be a critical driver for new developments in both computing and communications. In some areas (such as Computer Science and parts of Electrical Engineering) ICT itself is the subject of study, in some areas (such as Civil Engineering and structural Chemistry) it is an important enabler, and in other areas (in the social sciences and humanities, for example) entirely new computational approaches are redefining how research is done.

Since they are so wide-ranging, research needs are difficult to categorize and even more difficult to summarize. Although many individual researchers have historically addressed their specialized ICT requirements in their own offices and laboratories, strong central infrastructure and technical support are critical across-the-board requirements. The campus computer network, for example, is vitally important to our research activity in supporting access to information resources, collaboration with other researchers, and the movement of data among researchers. Ongoing development of this critical resource is required to meet the new demands of evolving and emerging research programs in areas such as structural sciences, computer-mediated collaboration, medical imaging, and bioinformatics. Increased capacity is essential to enable the exchange of the anticipated volumes of research data, to provide effective remote access to shared research facilities, and to permit researchers to communicate effectively with each other. Issues relating to the campus computer network are addressed more fully in Section 5.1.

The CLS is a dramatic and important example of the role that ICT can and must play in contemporary research. If the University and the CLS are to achieve their stated goal of being an outstanding international centre for synchrotron science and applications, we must provide a first-class venue for research collaboration among academic, government and industry partners. An experiment in a field such as protein structure generates large volumes of data at high rates of speed, and the ability to move this data quickly and reliably is vitally important to these scientists. Synchrotron scientists, both on-campus and off, tell us that substantial investments must be made in on-site facilities for capture, storage and processing of large volumes of experimental data, in facilities for fast, reliable, and secure transmission of this data to home laboratories, and in facilities to support remote working via virtual private networks, remote execution and video conferencing. Indeed, prospective CLS users tell us that they will take their business to facilities that offer them the ICT support they require. Campus ICT planning and CLS ICT planning must

continue to go hand in hand, as they have up to now. ICT infrastructure is critically important to CLS success and CLS requirements must be a central consideration in the University's ICT planning.

The newly established Bioinformatics Research Laboratory (BIRL) is an excellent example of the role that ICT can play in fostering collaborations among researchers. BIRL was established to support interdisciplinary bioinformatics research being carried out by 21 researchers in 6 departments. This research collaboration requires sharing of distributed computational and informational resources located both on- and off-campus. A centerpiece of BIRL is a CFI-funded high performance computer cluster to be shared among the participating scientists. Collaboration and cooperation are essential to research in bioinformatics. The ability to share resources (both informational and computational) and to communicate effectively is vital and requires state-of-the-art ICT capabilities. Saskatchewan-based researchers regularly access software and databases at the Canadian Bioinformatics Research (CBR) facility in Halifax and will soon be hosting several international databases (most notably in plant genomics, an area of local specialty) that will be important resources for other researchers. U of S scientists are already collaborating with scientists at NRC's Plant Biotechnology Institute and Agriculture and Agri-Food Canada, and we expect this type of activity to increase.

There are many other examples of the synergistic connection between ICT and research. Researchers in Computer Science are exploring the tools and techniques needed to achieve the full potential of a massively connected environment in various projects. With various grants from CFI they are addressing both the networking technology required to achieve performance goals and the cutting edge applications of this technology. A new research facility spanning the Universities of Saskatchewan and Calgary will support experimental research in internet technology, research in pervasive and mobile computing is taking place in a new state-of-the-art laboratory, and research in next-generation groupware is developing new technology to support collaboration using this infrastructure. Researchers in other disciplines have demands that stress our present ICT environment in other ways. A new CFI-funded high-performance computer cluster in Physics and Engineering Physics will address the significant computational requirements of several researchers. Researchers in Geography, Agriculture and Geological Sciences are embracing GIS as a research tool, and researchers in the humanities and fine arts are discovering new ICT-based research paradigms. Our institutional challenge is to be prepared for such demands, and to be ready to support them when the researchers come calling. In some cases the appropriate response involves local facilities (as in the case of the new high-performance computer clusters in Computer Science and Physics and Engineering Physics), but in other cases it might be to link to external suppliers. Our membership in the national C3.ca consortium[13] facilitates the latter approach to high performance computing. C3.ca acts as a "broker", matching those with high-performance computing needs with those with high-performance computing facilities. They also help to coordinate training and support. The C3.ca model is one that we can and should explore to

[13] C3.ca's mission, as articulated on its website (http://www.c3.ca), is "to significantly enhance the Canadian information technology and knowledge infrastructure, by creating a national network of shared computational research facilities interconnected by advanced communications, in order to increase the competitive advantage of Canada's social and economic institutions."

meet other needs that we may not be able to address locally. However it's done, we must ensure that we are able to identify and respond to the ICT needs of our researchers in a timely and effective way.

Access to "library" materials and services is fundamental to all research. Our Library has been a leader in ICT-enabled approaches to delivery of research materials for some time. Through the on-line catalogue our researchers have been able to access the catalogue resource from their desktops at all times of the day and night for years. Now, as one of the participants in the Canadian National Site Licensing Project (CNSLP[14]), the University has an opportunity to take this technology even further. CNSLP makes it possible for our researchers to access a large body of science and technology literature electronically. This presents significant challenges, however, both for the campus network and for the desktop systems. The cumulative impact of hundreds of simultaneous retrievals of large files of research information will mean a significant amount of additional traffic on the campus network, and desktop systems must be capable of dealing with the material once it is delivered to them. Providing this new service to the research community is vitally important, however, and so we must ensure that our infrastructure is able handle the increased load without compromising other activities.

If we are to achieve our publicly stated goal of positioning the University of Saskatchewan among the research leaders in the country we must recognize that our ICT infrastructure plays a critical role in contemporary research in many fields. Colleges must articulate the ICT requirements of their researchers in their own plans. Although much of the responsibility for identifying and acquiring specific research facilities lies with the individual researchers, there are areas where we can achieve economies of scale with central coordination. Central responsibilities include providing the reliable and secure campus network and server infrastructure that all researchers rely on (see Sec. 5), acquiring and managing campus-wide licenses, and providing the training that enables our researchers to make effective use of the technology they need. As an institution we must recognize and provide for these indirect costs of our research.

5. Infrastructure

Our ICT infrastructure is often overlooked as a capital asset, yet it is as important to us as the buildings in which we work and the electricity, water and heat required to sustain our working environment. The ICT asset comprises desktop computers and laboratory facilities, servers, the campus network, and the multimedia installations in the teaching spaces. As with any other capital asset, our ICT infrastructure must be maintained and renewed on a regular basis. Because our renewal of much of our ICT asset is funded by irregular and unpredictable sources, such as the Capital Equipment Fund and research grants, our renewal cycle is well beyond industry-accepted practices. The limited funds available have resulted in a large "deferred maintenance" backlog and the unpredictable nature of our renewal process adds considerable stress to our operations. Trying

[14] The U of S is one of 64 Canadian universities sharing in a $20 million CFI grant (http://www.uottawa.ca/library/cnslp/).

to support many generations of hardware and software dilutes support efforts, makes interoperability difficult, and frustrates users.

The provision of ICT infrastructure is never an end in itself, but a step to achieving the functional objectives associated with the University's activities and programs. In absolute terms the University has invested substantially (albeit sporadically) in ICT infrastructure already, but still the demand seems insatiable. The challenges for those charged with providing this infrastructure, those charged with supporting it, and those charged with financing it, are greater when the institutional commitment is unpredictable. This is most certainly an area where stable, predictable funding must be aligned with effective campus-wide plans.

5.1 The Campus Computer Network

With over 7200 connections to offices, laboratories, and classrooms in more than 40 buildings, the campus computer network is perhaps our most important ICT asset. The network provides critically important services to the entire campus and is constantly expanding as new space comes on-stream, new technology becomes available, and the demand from users, particularly new researchers, continues to expand and diversify.

Through a combination of vision, opportunity and hard work (with judicious commitment of resources) the University has developed a first-class campus network that is deservedly a source of institutional pride. This includes the backbone infrastructure, the end-user connections, and the interface to external networks. Despite the work and investment that have gone into the campus network, however, there is much more to do to keep pace with demand. Ten years ago, connections numbered in the hundreds and applications like the World-wide Web were non-existent. Now these are core requirements. We need to add many new connections to the network so that all members of the University community have access to both the internal and the external information resources they require, we need to expand its carrying capacity to meet the demands of contemporary applications, we need to enhance its reliability so that the service we rely on is assured, and we need to ensure its security. Funding allocated annually from the Capital Equipment Fund has been the traditional source of support for network evolution. New connections are being installed constantly, and speeds must be increased regularly in response to new and expanding demands. Over the past year, we realized a 50-fold increase in the speed of the University's connection to Canada's national research network, CA*Net, and our public internet service was upgraded as well. These changes have significantly improved service to all members of the University community.

But like the highways, the network is never completed. The horizon is constantly moving and so our target of full connectivity with the latest technology will always elude us. Space reconfiguration and the addition of new space adds to the backlog of new connections, and roughly half the present connections use old thin wire coax technology. Although this is being replaced with contemporary cat-5 cabling[15], the pace of renovation is slower than the user community demands, and the pressure to connect new space conflicts with the pressure to upgrade

[15] Category 5 (Cat-5) network cabling is the current industry standard. It supports speeds up to 1000 Mbps.

current connections. Our users demand high bandwidth for high-speed data transfer and to support emerging applications such as video-conferencing and on-line collaboration. A dramatic example of new demand is the Canadian Light Source (CLS) synchrotron facility. As the gateway to the CLS for both internal and external users, our campus network faces unparalleled demands for capacity and reliability when the CLS begins operation in 2004, and planning is well underway to make sure we are ready. At the same time, we work hard to stay "ahead of the curve" with field trials of emerging technology such as wireless access and internet telephony ("voice over IP"). We must be ready to respond quickly when the demand for a new service emerges. Completing the campus network with contemporary technology and providing for its ongoing support and renewal must be accorded high priority in the University's plans.

The successful outcome of our 2001 application to CFI provides us with more than $12M in external funding to help underwrite the cost of a $15M campus network development project dubbed *USR-net* (the University of Saskatchewan Research Network). When this project is completed early in 2004 we will have upgraded every existing connection, installed some 3000 new connections, replaced the core equipment in the campus backbone, moved to a routed network for improved performance and increased reliability, increased our network security, and expanded the capacity of our external interfaces even further. The subsequent announcement of a new Saskatoon connection to the federally funded CA*net4 national research network means that we will be well positioned to maximize the impact of both developments. The *USR-net* project is an ICT project of unprecedented scope and magnitude for the University of Saskatchewan, but one that will provide widespread benefits for years to come.

5.2 Servers and Support Systems

Although much of our ICT infrastructure is decentralized, the campus relies heavily on centralized services such as the following:

- **The shared server infrastructure.** This includes servers that provide time-shared computer resources for teaching, research and administration, campus-wide interactive voice response services, and network address management services.
- **The electronic communications infrastructure.** This includes the hardware and software required to support electronic mail delivery, directory services, web services, electronic commerce, electronic information distribution and collaboration.
- **The data and applications infrastructure.** This includes the databases and applications on which many of our institution-wide applications depend.

Services such as these represent an appropriate place for centralization since their use is campus-wide. We support more than 30,000 e-mail accounts for faculty, staff, students and alumni, and we process over 40,000,000 e-mail messages per year. We also provide web hosting and file services for more than 20,000 users. We have recently added institutional services such as Folder and Homepage to ITS's support responsibilities, and we expect to be adding centralized authentication and e-payment infrastructure soon. Centralizing the responsibility for such services and the facilities through which they are provided is both advantageous and cost-effective, and ITS has done an excellent job as steward for these services. Support implications, however, are

significant. Users expect 24-hour support, 7 days a week, 365 days a year. In other words, they expect these facilities to be operating whenever they need them. Fulfilling that expectation is a considerable challenge to both budget and staff, but a challenge that must be met. At present ITS does not have the resources to provide the support that users need and expect.

These systems are as important to our work environment as the heating system or the power grid. Quite simply, we could not do our jobs without them. As with any "utility" we must have plans for ongoing support, plans for maintenance and renewal, and plans for recovery in the event of failure.

5.3 Desktop Systems

The computer is now standard office equipment. Increasingly our faculty and staff use computers in everything they do. Yet we provide little or no central assistance in acquiring the facilities they need or renewing them as they become obsolete, only limited training in the effective use of either the hardware or the software, and often too little help when problems arise. We cannot set up expectations for an ICT-enabled workplace through our practices and processes, but then turn the other way when users have needs. We must establish effective (and consistent) institutional policies for provision, support and replacement of desktop computers.

In its 1999 report[16] Council's Information Technology Committee (ITC) lamented that effective use of desktop computing in our present environment is hampered by several factors, including:

- Our reliance on capital funding for the purchase of desktop facilities, so that acquisitions are episodic and ad hoc. This has numerous undesirable consequences:
  - It means long cycles of replacement (5 years or more).
  - Faculty and staff work with desktop computers that span many generations of hardware and software. The difficulties of supporting such a wide range of environments present significant problems for our staff, frustrate our users, and mean hidden costs to the University. Also, when our desktop computers run different generations of software, it can be difficult for our users to interoperate.
  - Because renewal is unpredictable, we tend to purchase higher capacity initial configurations than are needed. This increases our hardware costs.
- Our individual procurement culture. Because we have so many independent procurement agents we do not take advantage of the cash flow for hardware and software purchases. This dilutes our purchasing power, which ought to be considerable.
- Insufficient end-user support. Both faculty and staff have repeatedly identified this as a strong impediment to their ability to use technology effectively and efficiently.

The ITC concluded that we are preoccupied with buying hardware, and not sufficiently focused on what should be the real objective: making efficient and effective use of computers. Faculty and staff should not be purchasing agents, agents of self-support, or technology planners. Rather, they

[16] Information Technology Committee of Council, *Recommendations for the Strategic Application of Information Technology at the University of Saskatchewan*, November 1999.

should be concentrating on using technology to perform their primary functions of teaching, research and administration.

We lack a uniform approach to desktop computer investment that recognizes all costs. Because there are different approaches with dramatically different levels of funding, the needs of some units are adequately addressed while the needs of others are not. This creates an environment of envy and resentment. We must develop a University-wide strategy for desktop computing. We recommend that a strategy be developed around the following principles:

- Desktop computing should be viewed (and funded) as an operating expenditure, not as an episodic capital item that focuses almost solely on hardware purchase.
- Desktop computers should be renewed on a regular cycle. The University of Regina renews its entire desktop inventory on a 4-year cycle, with costs borne centrally. Although some of our Colleges have adopted a similar strategy, we have no common institutional practice (nor budget to support such a practice).
- A set of recommended software should be provided (and supported) as the foundation software common to all campus applications, including operating systems, productivity tools (word processors, spreadsheets, calendars, etc), e-mail and other communications tools, presentation tools, course management tools, and other common applications. Users may purchase additional, or different, software, but support can focus on the standard configurations.
- We must seek every opportunity to incorporate best practices in equipment acquisition so that we can shift some of our investments from hardware acquisition to providing better support to users. For example, we must harness our collective purchasing power to obtain the best possible vendor discounts. This approach has served us well with media equipment and can certainly be extended to computers.

Since the responsibility for desktop equipment presently rests with individual units, Colleges and administrative units must address these recommendations in their individual plans. We can then begin to have the campus-wide discussions that will lead to practices for acquisition, support and renewal of desktop systems that meet everyone's needs.

5.4 Security

Our systems and networks are under assault. Every week we block 100,000 to 200,000 e-mail messages from known SPAM sites and catch 2,000 to 3,000 viruses. Potential intruders scan our workstations and servers 700 to 800 times per day looking for vulnerabilities. This represents a significant challenge for the University, and costs us both money and lost time.

In order to protect our information assets we must embrace a campus-wide culture of best practice in ICT security. This includes not only firewalls and secure gateways but also mandatory antiviral software for all users. Security is everybody's business. We now have an institutional firewall and VPN (Virtual Private Network) technology, but our systems are secure only if *everyone* participates in ensuring they are. ICT security must be a high priority for the University and must become engrained as part of our culture, with adequate training and support.

6. Administrative Support Systems

6.1 Supporting the Business

Like any large enterprise the University cannot meet its business requirements without effective contemporary administrative support systems. Our "big five" major administrative applications (Financial Reporting and Management, Human Resource Management and Payroll Processing, Student Administration, Alumni and Development, and Library Services) are only some of the on-going systems on which we rely. Some of these have been developed centrally and are administered centrally (in ITS, for example), while others exist within colleges or administrative units[17]. Some of these systems interoperate, but most do not. As the systems age, the technology and process architecture used in their development become out-dated, putting critical business processes at risk. We risk complete failure, for example, when vendors withdraw support for software platforms and our staff lack the skill set to work on them. At the same time, we face ever-increasing demands and opportunities for new functionality to address internal or external policy changes or new demands from colleges and other units for access to information. This means either grafting the new functionality onto an existing structure or developing "shadow" systems to provide it. Either approach can compromise the structural integrity of our overall system design and make support even more difficult.

At the present time several of our key administrative systems are technically and/or functionally obsolete. Not only does this put University business processes at risk, it compromises our ability to provide competitive services and functions to our clients and even to our own staff. We do not yet have a firm commitment for the renewal or replacement of all these critical systems, nor have we identified sources of potential funding. We must undertake thorough and rigorous functional, technical, business and financial analyses, and develop a plan for coordinated development and management of our administrative systems.

Some progress has been made in recent years. Faced with the inability of our existing Human Resources Management System (HRMS) to function after the turn of the century, funding was set aside for the development of a new HRMS, *About-US*. Going first certainly did not advantage this project. Since the project has never been resourced to the level required, some of the functionality has never been implemented and the University has yet to benefit from the full power of the product that was purchased. Lessons learned on the *About-US* project have shaped the development of our second project, *Si!*, in the area of student information management. Following an eight-month analysis of the University's needs and options in this critical business area the Board of Governors accepted the recommendation of the project's Steering Committee to proceed with the purchase and implementation of a commercial product. A 15-year funding plan was developed that addressed both the implementation of the software and its ongoing support, and a project team is presently working to select an appropriate product and to develop an implementation plan. The *Si!* project is

[17] Facilities Management, for example, has in-house systems that serve institution-wide needs in areas such as classroom scheduling and project management. Student information needs are met through a vast array of loosely connected systems in various colleges and administrative units.

vitally important to the University in many ways: not only for the pervasiveness of the application and the services it will provide across the community, but also for the tone it will set for administrative support system projects that follow it.

As we take on new projects, the analysis of our needs and options provides us with opportunities to re-think the way we do things and to examine and adopt best practices. Our *About-US* experience helped us develop our approach to *Si!*, and we expect to learn even more as that project unfolds. We are learning from our experience (sometimes painfully) but we are also learning from the consultants we engage to help us. Among the lessons we are learning is that we need new approaches to system integration and project management. We are also coming to recognize the importance of post-implementation investment in realizing the potential of the overall investment.

6.2 An Enterprise Approach

> *"We can either [replace these individual systems] by a well-planned approach in order to move towards an integrated information architecture that serves the campus for the future, or we can take a helter-skelter approach that will perpetuate disintegrated, inaccessible information systems and will miss the opportunity to reengineer our work processes."* [18]

Our administrative support systems must interoperate to enable the cross-function information reporting and consolidation our business processes require. Problems arise when data is organized to optimize a specific system's local processing needs rather than the overall business needs of the institution ("functional stove-piping"). The absence of an institution-wide information architecture leads to duplication, extra cost, and inconsistent data. *Enterprise resource planning*, or ERP[19], is an approach to large-scale system design that attempts to address these problems. ERP seeks to integrate functions across an organization into a single architecture that can serve all needs. Each functional unit has its own piece of the system, which is optimized for the business needs of the unit and the particular ways that the unit does its work. ERP combines them all together in a single, integrated application framework that runs off a common database architecture, so that the various units can more easily share information and communicate with each other[20]. We need to think of our administrative applications in ERP terms, with focus on integration and interoperability. This does not necessarily mean commitment to a single vendor but it does mean that the development and renewal of our administrative applications must be planned in a coordinated way.

[18] Kavanagh, *Draft Process for the Renovation or Replacement of Institutional Information Systems*, University of Saskatchewan, November 1994.
[19] Sometimes referred to as *enterprise architecture planning*, or EAP.
[20] Derived from material found at http://www.cio.com/forums/erp/

6.3 E-Business: An Emerging Demand

With several units already exploring an e-business approach to some of their business processes, it is time to formulate an e-business strategy for the University. We run the risk of uncoordinated and inefficient development unless we come forward now with an institutional plan.

E-business has been defined as "a transformation of key business processes through the use of Internet technologies" [21]. Although it covers much more than financial transactions, the promise of more efficient commerce is a primary attraction for most.

For an enterprise as large and as complex as the University of Saskatchewan, e-business has tremendous potential and far-reaching impact. A growing number of units see the web as a vehicle for pushing their business interface out to the customer, everything from providing information to receiving payments. As always, we recognize that some services are best provided by individual departments, while other services are best delivered in a centralized manner, but we need an institutional e-business solution that is coordinated, auditable, and accountable, within which the full range of our requirements can be met.

6.4 Other New Initiatives

Interest is being expressed from various units in other emerging technologies. As with e-business we can move forward more effectively if we proceed in a coordinated way. We are presently evaluating options for an institutional portal with the expectation that one will be in place for the fall of 2003. Portal technology allows web-based services to be tailored to the needs of particular users and is a key element in our strategy to provide more of our services on-line. Interest is also growing for "business intelligence" products, specifically data warehouse products. A data warehouse is a copy of transaction data specifically structured for query and analysis (and reporting) outside the operational systems. Data warehouse products enable more effective decision-making by allowing users to combine data from multiple systems into a consolidated view.

As with any new technology it is important to balance the promise (the "hype") with the reality. Will the adoption of this technology increase efficiency, improve customer service, or otherwise provide business value; and if so, how and at what cost? What are the initial acquisition costs and what are the on-going support costs? Are these costs best borne centrally or in the individual units? What steps must be taken to ensure appropriate levels of privacy and security?

We believe there to be enough institutional benefit to justify acquiring such products centrally and making them available for the entire campus to use. Proliferation of independent solutions in and by different segments of the campus could create inefficiencies and confusion, and diminish their effectiveness. We are currently investigating options and products, and will be developing business plans for review by interested parties.

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[21] Weidong Kou and Yelana Yesha (editors), *Electronic Commerce Technology Trends: Challenges and Opportunities*, IBM Press, February 2000.

7. Staffing

ICT is about people, not just technology. Without adequate staffing, our equipment is just "stuff". As an institution we have been slow to realize this. Staffing in ICT-related areas presents special challenges because the worldwide competition is intense. Even after the "tech wreck", competition from the private sector exacerbates an already difficult recruiting environment. We have much to offer at the University of Saskatchewan, but we must ensure that we can provide a competitive package, not only to attract those we are trying to recruit but also to retain those we presently have.

Our ICT staffing needs fall into three broad categories: we need staff to develop the technology and applications upon which we rely in our various activities, we need staff to provide ongoing technical support, and we need staff to provide user assistance and training. At the U of S the ICT staff we currently have is widely distributed. Many are in central support units such as ITS and DMT, some are in colleges, and some are in individual departments and administrative units. Many have irregular appointments, funded by various ad hoc mechanisms. We are too vulnerable when a critical resource is in such an uncertain state. We must assess staffing needs realistically and secure adequate base budget resources to meet them. It is important that we recognize the challenge our staff face in keeping their knowledge and skills up to date in these rapidly changing areas. We must provide them with adequate opportunities for ongoing professional development.

ICT staff are an extremely valuable resource and we are playing in a highly competitive arena. In the current marketplace recruiting is a significant challenge. The University is extremely fortunate to have the talent base it has when it has done so little to provide competitive salaries and stable career paths. Institutional loyalty has been our retention strategy, but this can be stretched only so far. As we move to increase our ICT investment we must direct more attention to our human resource. We must establish a competitive salary structure and career development opportunities (both of which are presently lacking) for our ICT professionals, and the funding for this must be regularized in base budgets.

8. Risk and Risk Management

As we become increasingly reliant on ICT to support our business and academic processes, we also become increasingly vulnerable to its failures. It is important that we understand the areas in which we are exposed, assess the degree of our vulnerability, and identify actions that we can take to mitigate any consequences. Responsibilities must be clarified in the areas of risk assessment and risk management, and effective control processes must be put in place.

Risk is inevitable and unavoidable in a field where we must often act quickly to remain competitive. Our exposure can take several forms. We are at risk when a system on which we depend might fail to function properly, or when critical data is improperly secured against damage, loss or theft. Threats can take the form of system or component failure, deliberate attack,

or natural disaster. The consequences could be minor or they could be catastrophic, depending on the system or business processes affected. Risk management comprises policies, procedures, and standards to assess risk, to determine acceptable levels, and to assure that our systems and processes are developed and operate with appropriate controls.

Although isolated groups have been active in this area, we must develop greater awareness across the institution. In 1996 the Task Force on Computer and Network Security carried out a risk analysis based on methods for general planning for disaster recovery from the Canada Emergency Measures Office. This analysis yielded a large number of individually identified risks, which were subsequently rated as to probability of occurrence and potential impact. Unfortunately, the effort largely stalled at that point and these risks have been dealt with in an ad hoc fashion.

Pressures from a number of groups, including Audit Services, Security Services, ITS and the Provincial Auditor, have resurrected this activity. In the fall of 2001 an ad hoc steering committee comprising representatives from Audit Services, Security Services, and ITS began to chart a new course. From this work a new body emerged, the IT Risk Management Committee, whose task is to develop institutional processes and ensure that they are followed. Three subcommittees, Data & Applications, Systems & Networks, and IT Security, are now responsible for specific areas of our operation, while the Management Committee plays an oversight and coordination role. This body has an important role to play and we must see that it is inserted into our business practices. As a first item of work, the IT Risk Management Committee is addressing the need for institutional policies to ensure appropriate use and management of both our computer resources and our data resources.

9. Organizational Issues

Organizational issues cut across a number of dimensions. There are issues relating to the organization of the units responsible for providing and supporting our ICT infrastructure, there are issues relating to the organization of specific projects, there are issues relating to the organization of the collegial committees that provide advice and direction, and there are general organizational issues. In setting up our structures, however, we must guard against rigid adherence to formalized procedures and tight controls that might discourage the ability to experiment and innovate that is so important to success in such a rapidly evolving field.

9.1 Organizational Structure

In any large organization, organizational structures reflect many competing pressures – including the political environment, the budgeting framework, and the cultural context. Organizational structures are not easy to set up, and they are even harder to change. The way we organize ourselves for ICT can significantly influence our effectiveness. Despite the inevitable resistance to change any organizational structure, we must ask if our present ICT organizational structure helps us or hinders us in meeting our institutional goals. We must ensure that we have the right

allocation of authority, responsibility, and budget. We must ensure that decision-making is appropriately situated – with the right collegial processes and the right reporting channels. Having the right organizational structure is not sufficient to create an effective operation, but having the wrong structure can present a major barrier.

Many campus units already have a significant stake in ICT. As has already been noted, the University's model for ICT is a highly decentralized one, with significant distribution of responsibility, authority, budget, and control to colleges and administrative units. Information Technology Services (ITS), Media and Technology (DMT), the Extension Division, Facilities Management, Human Resources, the Library, Student and Enrolment Services, the colleges, and even some departments have substantial ICT enterprises. Decentralization may alleviate concerns of authority and accountability, but it also perpetuates inefficiencies when units put their resources into developing "silos". We must bring these often-competing interests together within a single institutional plan. This requires two things: broad institutional consensus and strong leadership to represent ICT interests at the highest level.

To develop the broad institutional consensus, we need effective ICT governance at all levels – in departments, in colleges, in administrative units, and in senior administration. Each college should have an ICT committee, for example, and representatives of these college committees should form a University-wide body where institutional goals are discussed, institution-wide planning takes places, and policies and procedures are established for all.

9.2 A Federated Model

Centralization brings advantages of scale economies, enterprise-level planning, and institution-wide control of standards (best practices), yet it can be perceived as unresponsive to individual unit needs. Decentralization offers local control of priorities and expenditures, but can create costly redundancies, fragmented competencies, and uneven service delivery. Indeed, the focus on individual unit needs can be at the expense of institutional needs. A true University-wide ICT strategy will be difficult to achieve in a decentralized model.

A federated approach seeks to balance these two opposing models by allowing individual units to take responsibility for local priorities in the context of institutional priorities. It is possible to respect the autonomous nature of individual units and achieve the scale economies of the centralized model if there is agreement on where responsibilities rest. Strong and effective central leadership, with significant local input, is a hallmark of a successful federated model.

The U of S already has a federated model for ICT, but the lines of responsibility and authority aren't as clear as they need to be. We need to sharpen our collective understanding, but we have some significant successes to guide us. Planning is underway, with the help of external consultants.

9.3 Project Management

> *"The University needs to strengthen its management practices over information technology (IT) projects and controls over changes to IT programs."*[22]

Concerns about organization and governance apply as well to our large ICT projects. We must be clear on issues relating to ownership, responsibility, and management. Who initiates a large project? Who participates? Who is responsible for securing the funding? Who controls it? Who manages it? These are all critical questions and we are beginning to show that we understand their importance as we structure the new projects we are moving forward.

We need open and visible processes for project development, project approval and project funding. We should have a standard template that can be readily deployed each time a new project emerges. This template must reflect best practices in project design, project management, and project oversight.

Up until recently we often relied on ad hoc and informal arrangements for project management, but both experience and advice from external observers have taught us that we can no longer satisfy this critical requirement in the way we have. No longer can we simply borrow someone from the affected functional area and task him or her with managing the development of the new system. Without criticizing those who have served admirably in such positions, this is not an effective approach. Without trained and experienced full time Project Managers it is difficult for us to manage priorities and expectations appropriately and to deal with conflicts in scope, time and budget. Well-managed projects are characterized by well-defined plans, with realistic budgets and schedules, use of an accepted project management methodology, a process to track, control, and approve changes, candid and effective communication, and a rigorous quality assurance process. There is a discipline here and a body of knowledge, and we need people that come with both.

As the name implies, a Project Manager is responsible for managing a systems development project, from its design, through its implementation, to its ongoing operation. He/she serves a critical coordination role as an integration point between the project sponsors, who set strategic direction, and the technical teams, who do the implementation. The Project Manager develops the project charter, the project plan, the project budget, and the project schedule, and is responsible for ensuring that the project progresses within the established parameters, both in implementation and in ongoing support. Project Management methodologies exist to facilitate this and they must be rigorously applied.

To ensure the success of the important (and costly) information system projects that lie ahead, we can no longer fill this critical role with temporary secondments or add these significant responsibilities to people whose plates are already full. We must accept that full-time Project Managers must be in place to provide assistance in setting priorities, establishing and managing project budgets, and overseeing implementations. Professional Project Managers possess the skills

[22] The Report of the Saskatchewan Provincial Auditor, 2001

needed to ensure the successful completion of our projects and we must take the necessary steps to fill this gap immediately. Some progress has been made with the recent appointment of Project Managers for the *About-US*, *Si!* and *USR-net* projects, but we also need an effective organizational model for Project Management. Should Project Managers reside in the respective sponsoring units or should we create a Project Management Office?

10. Returns on ICT Investment

In the contemporary university ICT must be seen by all as an area for investment, not just as an expense. The University of Saskatchewan has made substantial investments in ICT over the past year, with special emphasis on several large projects:

- The *Si!* project involves the selection and implementation of a new Student Information system for the campus. This is a critical project at the core of what we do, and the user base is large and diverse. It also provides us with an opportunity to realize efficiencies as we examine closely our academic policies, processes and practices, and integrate the many shadow systems presently in operation across campus.
- The *USR-net* project will provide us with a campus computer network second to none in the country. It will permit us to explore new and improved approaches to many things we are presently doing, and will present opportunities for us to do things that are not currently possible.
- The student computing project has seen the introduction of new facilities, new delivery paradigms, and a new business model. This project is a transformative one that changes the way we address the ICT needs of our students.
- Over the first five years of the classroom renovation project we have invested $2.5M of Capital Equipment Funds in the renovation of many of our lecture theatres, and have excited both students and faculty with the potential of the technology. The transformation of our classrooms to contemporary technology standards is an expensive undertaking, but one that must continue for us to remain competitive with our peer institutions.
- We are investing both energy and resources in the exploration of distributed learning technology, to understand how this technology can benefit both on-campus and off-campus learners. Funding from the Province's TEL initiative is being used to develop courses for on-line delivery and to increase our institutional ability to use this technology effectively.

We can expect significant returns on those investments, but we must be realistic in the types of returns to expect. Investments in ICT rarely "pay for themselves" in terms of saving dollars by eliminating staff positions or reducing operating expenditures. Where then is the return?

The returns on our ICT investments (the ROI) will be in the areas of new services, improved support for core activities, and new opportunities. As Graves[23] points out,

> "[P]roviding customer-satisfying IT services … becomes a lever for improving … higher education's core assets–its intellectual capital"

[23] Graves, "New Educational Wealth as a Return on Investment in Technology", *EDUCAUSE Review*, July/August 2002.

Our investments in ICT will generate returns in the area of new services to students, faculty, staff, and others with whom we interact. Investments in a new Student Information system, for example, will provide us with the ability to provide new services to students such as on-line registration and degree audit, and timely access to accurate and comprehensive information on our students will provide new opportunities for our senior administrators to make informed decisions. Investments in student computing will demonstrate to everyone that we place a high value on enhancing the student experience, and investments in the campus network will provide our researchers with the tools to access information services and resources – wherever and however they might be maintained. Aspiring to meet national and international standards as a University means we must provide national and international standard ICT.

But the investment we must make is only partly financial. We must also invest in new ways of doing things – new approaches to solving problems and new organizational models. In a highly distributed environment such as ours, considerable authority, responsibility and budget are devolved to individual units. At the same time, we need effective central control so that our unit-based decisions and unit-based activities work together to achieve our common goals in cost-effective ways. A federated approach to ICT offers the promise of blending the advantages of centralized control with the advantages of distributed authority if we can work collaboratively. Working together will enable us to move forward in ways that are not possible if we're rowing in different directions.

We have many challenges ahead to realize the returns we must expect from out ICT investments: technical challenges, organizational challenges, and financial challenges. Our institutional acceptance of the President's Strategic Directions demonstrates that we have the resolve to get to where we need to be as an university. We need to put plans into action to get there. We look forward to working with each and every unit to integrate ICT into their plans, and in using these plans to achieve our shared goals.

11. Moving Forward

With the substantial investments the University has made in its major ICT projects over the past year it is important that each unit consider how it can best capitalize on the opportunities that these investments will provide and develop plans around these commitments accordingly. At the same time there are many new challenges presented by the combined pressures of ever-advancing technology and mounting user demands. How will the unit address equipment acquisition, replacement and support pressures, for example, and how can we most effectively integrate this new technology into our working practices (teaching, research, service, administration)?

To achieve full benefit from our ICT investments, now and in the future,we must proceed in a coordinated way. We must address individual unit needs in the context of institution-wide needs. Priority must be given to developing and enhancing ICT services that contribute directly to strategic plans. These plans may come from the individual unit level, from colleges or divisions, or from the university as a whole. Collaborations and partnerships will continue to be important,

and strong leadership will be required to bring this all together, and ensure that we move forward in an effective way.

In closing, we have made significant advances, but we must continue to be forward looking, to track emerging technologies and anticipate both demand and opportunity if we are to remain a nationally competitive institution. This will require commitment and effort from all of us.

Appendix One

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Appendix Two

The Drafting Committee

The Drafting Committee for this document was:

- Rick Bunt, Associate Vice President, Information and Communications Technology
- Barry Brown, Chair, Information Technology Committee of Council
- Donna Canevari de Paredes, representing the Planning Committee of Council
- Danielle Fortosky, Director, Division of Media and Technology
- Jim Greer, Head, Department of Computer Science, and a member of the Budget Committee of Council
- Lea Pennock, Program Director, Student Information Systems
- Ed Pokraka, Director, Information Technology Services Division
- Frank Winter, Director of Libraries

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Consultations

Town Hall presentation

- February 12, 2003

Presentations to Council Committees

- Planning Committee
- Information Technology Committee
- Capital Planning Committee

Discussions by other Council Committees

- Budget Committee
- Audio Visual Committee
- Instructional Development Committee

Other Presentations

- Two Town Hall meetings with students
- Information Technology Services staff
- Deans Council
- Administrative Council
- College of Agriculture Executive
- Department of Computer Science