

Graduate Studies and Research
at
Simon Fraser University

A Report from the
Presidential Committee on University
Planning

TABLE OF CONTENTS

Preface

1. Overview
 - 1.1 Graduate Studies and University-based Research
 - 1.2 A Profile of Graduate Studies and Research at SFU
 - 1.3 Strategic Directions
 - 1.4 Advanced Education
2. SFU Graduate Studies and Research in Context
3. Issues in Graduate Studies
 - 3.1 Enrolment
 - 3.2 Program Quality
 - 3.3 New Program Directions
 - 3.4 Graduate Student Funding and Tuition
 - 3.5 Operational Issues
4. Research Issues
 - 4.1 Research Funding
 - 4.2 Support for Scholars
 - 4.3 Research Facilities

PREFACE

The Presidential Committee on University Planning (PCUP) has been charged with the task of providing a strategic plan to carry Simon Fraser University from 1996 to 2004. To engage the SFU community in debate about its future, PCUP has issued discussion papers dealing with undergraduate programs, graduate studies and research, and has developed an overall report that articulates a vision of the university and outlines several important measures to achieve that vision. After public hearings, the contents of the discussion papers, appropriately revised, were distributed as draft reports to the community for further comment. The end results of this dialogue and debate are three reports:

The Undergraduate Program at Simon Fraser University
Research and Graduate Studies at Simon Fraser University
Nous sommes prêts: Planning for a decade of change at Simon Fraser University.

In addition, two working groups associated with PCUP developed discussion papers and reports on instructional technology and services to students

All of the discussion papers and reports were circulated to the SFU community through *Simon Fraser News*. Literally hundreds of students, staff, faculty, alumni and members of public have contributed oral and written presentations to our planning process. We very much appreciate the time and effort that these individuals devoted to formulating and communicating their arguments.

The Presidential Committee on University Planning

Greg Basham, Alumnus
David Boal, University Planning Coordinator
Ameé Chande, Business Administration undergraduate student
Dave Crouch, Kinesiology graduate student
Jamal Deen, Engineering Science
Lee Gavel, Facilities Management
Judy Higham, Office of the Vice-President, Academic
Jack Martin, Education
Catherine Murray, Communication
Carolyn Smart, Business Administration
Mary-Ann Stouck, English
John Stubbs, President

12 May, 1996

1. OVERVIEW

University communities are concerned with knowledge: the collection and preservation of knowledge, the advancement and application of knowledge, and the transmission and diffusion of knowledge through teaching and learning. Research and graduate studies are integral to these knowledge-based activities, which include the pursuit of a basic understanding of the world and our place in it, the development of strategic knowledge in areas deemed to be important for the public good, and the application of knowledge to problems of economic, educational and social importance. The private sector and other public sector institutions also are active in research, although the proportions of each sector's research activities in basic, strategic and applied research are different.

The current status of research and graduate studies at Simon Fraser University is reviewed in this section of the paper, and described more quantitatively in Section 2. Sections 3 and 4 contain recommendations that PCUP believes SFU should adopt in order to maintain and improve the quality of our research environment and graduate programs. In this report, the word "research" is used to denote a broad range of traditionally understood scholarly activities, and also includes curriculum development, aspects of contract research and consulting, and public performance and exhibition in the arts.

1.1 Graduate Studies and University-based Research

In academic disciplines, research and graduate studies exist in diverse relationships. Many graduate degrees are research-based, and students in these programs are active in the university's research efforts. Of equal importance, a university also offers advanced professional training that requires a previous undergraduate degree but that may not include a research thesis. The distinction between professional and research degrees is not as sharp as it may appear: the specific knowledge and applied skills that are acquired by research-degree students are important aspects of their graduate education, just as the tools and techniques gained by students in professional programs also are applicable to research problems.

While personal benefits, both economic and intellectual, accrue to the holder of a graduate degree, broader benefits are provided to

society by graduate education. Graduate degree-holders are abreast of current practice in their discipline and contribute to their work environment at a high level, both independently and as a team member. They may take an entrepreneurial role in their work and have had contact with and exposure to the best researchers and practitioners internally, nationally and internationally through frequent colloquia and visitor programs. Finally, most graduate students have experience in instruction that allows them to teach in the traditional classroom or in a workplace setting.

Graduate programs also benefit the University, through the presence of graduate teaching assistants who take part in the teaching activities of the University, thus reducing the cost of education and providing a view of teaching activity that is closer to the undergraduate learner. Graduate students also contribute to the research environment of the University through their thesis research, collaborative projects with faculty and, in some disciplines, public presentations and exhibitions.

The knowledge generated by our research personnel finds application in the economic, educational, judicial and social agencies of the public sector and in the industrial and commercial activities of the private sector. However, the classic view that heart of the university research mission is the pursuit of knowledge for its own sake, is increasingly being called to account. PCUP acknowledges that SFU must make a determined effort to demonstrate how its collective research efforts benefit British Columbia, Canada, and the broader global community, in a number of tangible ways. Further, the public must be convinced that university research meets the test of excellence and relevance over time.

Research and graduate studies may be linked in varying ways in faculty workloads; in some disciplines, graduate supervision is directly related to a faculty member's own research program, while in other disciplines, it is not. The level of financial support needed to sustain excellent research also varies. PCUP believes that the dependence of research quality on grant support and other variables is poorly understood and we suspect that in many disciplines, there is no such relationship.

University research is funded by both public and private grants, contracts, scholarships, stipends and salaries. Public funding (now under considerable and increasing restraint) is by far the

largest source of direct and indirect support for university research. Society enjoys a return on its investment in university research in many ways and over many time frames. Important components of our technological world have their roots in fundamental research done a century or more ago. On a shorter time scale, applied research may have impact in today's social, educational and economic realm.

Social benefits of our research include:

- providing an independent critique of both public and private policy
- understanding our history, and using it to guide our plans for the future
- determining the effects of human activities on our climate and environment
- preserving, understanding and interpreting the documents and practices of our cultures
- analysing theory and practice in the criminal justice system
- developing the framework for debate on social and cultural issues.

Our educational research goes beyond curriculum development for our children's schools, and extends to the advancement of new learning methods, sometimes technologically-based, that will

- improve access for disadvantaged students
- increase opportunities for life-long education
- foster curiosity and creativity in the learner.

The economic impact of university-based research includes:

- performing fundamental research of importance to many private and public agencies, which no single agency has the in-house capability to carry out
- developing means to improve the efficiency of managerial methods and innovation processes
- generating patents and applied research that may further enhance our economic growth
- contributing to the cultural and entertainment enterprises that are an increasingly important component of our economy.

Because of the strong interplay between them, both directed and curiosity-driven research are necessary in a university environment. There are countless examples of applications that have evolved rapidly out of curiosity-driven research, just as there are examples of fundamental studies that have been initiated in response to advances in applied research. Further, new research

methodologies which can accommodate complex systems, such as climatological change or economic modelling, are being developed to complement the traditional reductionist approach to problem analysis. Universities are at the frontier in developing information technology to provide new tools for accessing the world's expanding knowledge base.

The results of university research are disseminated through teaching, publication, peer-reviewed public presentations or exhibitions, and technology transfer. Conventionally, publication of research results occurs through journals, monographs, conference presentations and proceedings that have unrestricted access. Because some research has immediate economic significance, disclosure of results may occur through patents or commissioned technical reports. Through public distribution of results, university-based research is communicated as broadly as possible to the community.

Research roles are not mandated to all postsecondary institutions but are relatively unique to universities. There are now twelve institutions in BC that grant undergraduate degrees, but only four of these institutions may grant graduate degrees. Future provincial policy may expand the programs at the eight BC undergraduate institutions to include graduate degrees. SFU must evolve in response to the establishment of competing undergraduate institutions, and place more emphasis on activities which are not yet part of the colleges' mandates: graduate degrees, professional programs and research.

1.2 A Profile of Graduate Studies and Research at SFU

Simon Fraser University offers graduate programs in almost all areas for which we have undergraduate programs, but because undergraduate students represent about 87% of our total full-time equivalent (FTE) enrolment, faculty are hired largely in disciplines needed for undergraduate teaching. Faculty research programs largely mirror the core undergraduate programs of the University.

Currently, the fraction of SFU students enrolled in graduate programs is close to, but slightly below, the overall Canadian average of about 15%. However, the overall level of participation in postsecondary education in BC will rise over the next decade, as the new university-colleges develop. Because a number of the

university-college graduates undoubtedly will seek further education, SFU can expect growing demand for graduate programs from students within BC. Professional degree programs are more likely to experience demand from BC students than are research degrees, which tend to draw more of their students from national and international sources.

Women now represent 46% of graduate students, although there is variation across disciplines. Overwhelmingly, students enrol in graduate degrees on a full-time basis; only the Faculty of Education shows a considerable part-time enrolment. International students represent about 15% of the graduate student population, similar to the Canadian average.

On an individual basis, SFU faculty and graduate students are of high quality. As summarized in Section 2, SFU is in the top fifteen, but not in the top five, of Canadian universities as judged by conventional, but not uniformly accurate or necessarily appropriate, measures of per capita research strength. However, in the absence of a medical school, the University receives less federal research funding than most universities of similar size in Canada.

1.3 Strategic Directions

Having considered the financial and institutional challenges that SFU will face in the next decade, PCUP proposes several strategic priorities to guide our research and graduate activities. Our success should be judged by the progress that we make towards meeting these objectives.

- Excellence.* While there are many areas of research excellence at SFU, all academic units should strive to be among the top 25% of their peer group in the approximately twenty Canadian universities with extensive graduate programs, by the year 2005. Performance indicators, consistent with national standards for research and graduate studies in their fields, should be developed by each academic unit. Rigorous departmental reviews should place a high emphasis on quality and the University should implement measures to close low-quality graduate programs. In accordance with the decentralization of budgetary authority, measures must be put in place to reward excellence at the local administrative level.

•*Knowledge mission.* Research and teaching are cornerstones of the University. All faculty should be actively involved in the scholarly mission of the university, which includes the generation, diffusion and application of knowledge as defined by their specific appointments.

•*Advanced Education.* The University should make a commitment to recruit the most promising graduate students through firm financial support and excellent research facilities. Where applicable, faculty should continue to seek external grants in support of their research students. The University should respond to the increasing demand for professionally-oriented masters programs which can reasonably be expected, in a number of cases, to charge higher than average tuition fees. PCUP has considered, but does not advocate, the establishment of a School of Graduate Studies as a mechanism to regulate advanced education.

•*Accessibility.* Subject to financial and personnel resources, the University should minimize the barriers facing well-qualified students who wish to enter graduate programs at SFU. Initiatives to reduce such barriers may include scholarship and bursary support, orientation programs for international students and the provision of part-time graduate study, where appropriate.

•*Responsiveness.* Some aspects of SFU's research programs should be of direct economic and social benefit to BC. Good communication with our provincial constituency is needed to make town and gown more aware of each other's needs and capabilities. Such communication can be encouraged through Co-operative Education and the University-Industry Liaison Office and through the extensive use of advisory/liaison boards, particularly at the departmental level.

•*Equitable tuition.* Both graduate and undergraduate education continues to be highly subsidized by public funds. On average, the fraction of graduate education costs covered by tuition should be in approximately the same proportion as that of undergraduates. Recognizing that the economic payback to graduate degree-holders varies considerably, some graduate programs should charge higher tuition than others.

Co-operative Education and research internships in selected graduate programs, including Arts, are important aspects of our

communication with employers and should be strongly encouraged. SFU's Co-operative Education Advisory Council anticipates that employment demand will be higher at the masters level than the doctoral level for graduate co-op degrees. As well, extending the two-way flow of personnel between the university and the public and private sector will strengthen our research environment, especially in interdisciplinary areas. Initiatives to encourage the exchange of personnel may include

- (i) the appointment of researchers from outside SFU to visiting or adjunct faculty positions, and
- (ii) the placement of SFU faculty into external research institutions on a part-time or temporary basis.

Co-operative education should become a cornerstone of the University at both the graduate and undergraduate level.

1.4 Advanced Education

We outline in Section 1.3 our expectations of the University in delivering advanced education and performing research. In its *Report on the Undergraduate Program at Simon Fraser University*, PCUP has outlined a set of expectations of undergraduate degree-holders, and a number of these characteristics are required of graduate students entering some disciplines. All advanced degrees require students to have generic skills in problem analysis and to have the ability to work independently. In some research disciplines, there is a strong need for graduate students to demonstrate excellence at the undergraduate level in their field of academic expertise. In all disciplines, written and verbal communication skills are just as important for graduate students as they are for undergraduates.

Graduate programs cover an expansive knowledge base and have widely varying educational goals. While it is difficult, and probably undesirable, to define a common level of achievement for students who complete these programs, PCUP believes that there are some universal characteristics that holders of SFU graduate degrees should possess.

At the masters level,

- all students should have a high level of knowledge in their field of study that goes considerably beyond undergraduate education.
- research degree students should have a thorough knowledge of research methods appropriate to their discipline.

- professional degree students should have a level of expertise which prepares them for employment in their specialty.

At the doctoral level, all students should have

- the ability to perform advanced, independent research
- a thorough knowledge of the intellectual frontier in their subject area
- sufficient skill and experience to teach or transfer their knowledge effectively.

Graduate students at Simon Fraser University expect to work in an environment free from harassment and discrimination. The University already has in place an administrative office to handle complaints arising from inappropriate behaviour in the workplace and to enforce university policies regarding such behaviour. SFU strives to provide a research and teaching environment in which all members of the SFU community can achieve excellence in their endeavours.

2. SFU GRADUATE STUDIES AND RESEARCH IN CONTEXT

Simon Fraser University is a rapidly evolving institution, with a growing student population and faculty complement. Our undergraduate admission standards are now very high and degree-completion rates are correspondingly very good. Budgetary growth resulting from undergraduate program expansion has allowed us to diversify the program base of the University, to add more facilities and to increase our research capability.

This section contains a synopsis of graduate studies and research at SFU, and makes some limited comparisons with other Canadian universities. Because our discussion of specific issues frequently involves interrelated aspects of both research and graduate studies, both areas are included in this section. However, our analysis of, and strategies for, graduate studies are presented primarily in Section 3, while Section 4 focuses on research.

Like UBC, SFU draws more than 80% of its undergraduate population from the BC Lower Mainland. However, our graduate students are drawn from national and international sources and our research efforts are judged by international standards. Before we debate what new directions our research and graduate activities

might take, it is important to have a common understanding of those activities in the national context.

National data are not uniformly available for all institutions and for all indicators that one might wish to construct. Commonly used descriptions of research activities, such as funding levels per eligible researcher, are frequently of limited value in describing the quality of a research program. We recognize these shortcomings, and propose in other sections of this paper that SFU develop appropriate progress and quality indicators in conjunction with other universities.

The most consistent Canadian database available has been compiled by *Maclean's* and the Association of Universities and Colleges of Canada, and we use this database to construct comparative indicators. PCUP defines a comparison group of 19 universities that represents most institutions with extensive research and graduate programs (Alberta, UBC, Calgary, Dalhousie, Guelph, McGill, McMaster, Memorial, New Brunswick, Ottawa, Queen's, Saskatchewan, SFU, Toronto, Victoria, Waterloo, Western Ontario, Windsor, York). Comparable data are not available from Manitoba, Carleton and many of the Quebec universities. Details of the comparisons are given in the following paragraphs and summarized in Table 1. The comparisons should be regarded only as descriptive, and not necessarily as indications of institutional success or failure. It is worth pointing out that the majority of institutions in the comparison group have substantial programs in health sciences.

Table 1. Comparison of research and graduate studies at SFU against a 19-member comparison group. Most comparisons are from 1992 to 1994. Private sector sources of funds are not included in this table (AUCC/Macleans, 1994).

Indicator	SFU	Comparison group		Rank (of 19)
		Low	High	
FTE graduate enrolment	1679	690	5789	13
Total federal research expenditures	\$12.6M	\$5.3M	\$87.0M	17
NSERC \$ / faculty	\$40,000	\$24,100	\$78,700	14
SSHRC \$ / faculty	\$5,500	\$720	\$9,400	6
NSERC graduate scholarship funds per faculty	\$5,500	\$830	\$8,750	7
SSHRC-funded graduate students per faculty	1:33	1:330	1:13	8
Library volumes per student	126	111	300	17

Graduate student population

The graduate student population at SFU has grown along with the faculty complement, and in 1994 there were 1679 FTE graduate students. Graduate students make up about 13% of our total student body, a fraction that is near the average for the comparison group. Visa students made up about 14% of our total graduate student population in 1994, a proportion that is close to the Canadian average of 15% [Canadian Assoc. for Graduate Studies Report, 1993]. The gender imbalance that existed several decades ago at the graduate level has now all but disappeared. The fraction of female graduate students has risen from 43% in 1989-90 to 46% in 1993-94, and one might expect that the gender balance will shift to a female majority by early in the next decade, just as it has already in the undergraduate population. Most graduate students study on a full-time basis: in 1993/94, more than 90% of the full-time equivalent (FTE) graduate students were registered full-time. However, some Faculties, particularly Education, have a significant part-time enrolment.

Graduate degrees: supply and demand

The fraction of graduate degrees awarded by SFU, compared to the total number of degrees awarded, was 14.9% in 1990. This is about the same as the overall Canadian average of 14.2% for all

degrees awarded in 1990 [Statistics Canada, 1994]. We do not have accurate information about the career history of our degree-holders. Nationally, the employment of degree-holders is generally higher at the Ph.D. level than it is at the bachelor level, as shown in Table 1.

Table 2. Percentage unemployment rates in 1992 according to degree received in 1990 (Statistics Canada, 1994).

Field of study	Bachelor	Master	Doctoral
Fine and applied arts	15%	16%	27%
Humanities	13	15	14
Mathematical/physical sci.	11	11	6
Agriculture/biological sci.	15	9	5
Social sciences	12	7	6
Engineering/applied sci.	11	9	3
Education	9	3	4
Health professions	5	5	3

External research grants

At many Canadian research universities, about 2/3 of the external grants for research come from federal government sources, with the remainder coming from provincial and private sources. SFU is typically Canadian in this regard, with \$15.3M in research funds coming from federal sources out of a total of \$21.4M from all sources in 1994/95. Private sector funding for SFU research from Canadian firms and foundations has increased steadily from \$1.4M in 1990/91 to \$3.5M in 1994/95. Unfortunately, research support from BC government sources has declined from \$3.3M to \$1.1M in the same period. Overall, the growth in external funding has been good, rising from \$15.7M in 1990/91 to \$20.5M in 1994/95.

The total value of research grants and contracts at SFU is modest, mainly because of our particular program mix. On a per-capita basis, the grants received by SFU researchers in the 1992-94 period were close to the average of the comparison group. Total funding per eligible faculty member from the Natural Sciences and Engineering Research Council of Canada (NSERC) was \$40,000; total funding per eligible faculty member from the Social Sciences and Humanities Research Council of Canada (SSHRC) was \$5,500. Interprovincial comparisons of non-federal funding to universities

are difficult to make, because provincial sources of research support are highly variable.

Institutional attractiveness

Meaningful indicators of success in attracting outstanding graduate students are difficult to come by. One imperfect measure is the number of national scholarship-holders per faculty member (not per enrolled graduate student). This may be an indicator of success in attracting excellent graduate students normalized to the number of faculty eligible to supervise students. It is not a measure of the success rate of graduate students in obtaining national scholarships. SSHRC and NSERC report their graduate student awards and financial support in different ways. Averaged over 1994/5 and 1995/6, there was one SSHRC graduate award for every 33 SSHRC-eligible faculty at SFU [SSHRC, 1994 and 1995]. In 1994/5, NSERC-eligible faculty at SFU attracted graduate students with an average of \$5,500 in NSERC graduate scholarships [NSERC, 1995]. Both of these success rates in attracting highly qualified students are somewhat above the average of the comparison group, as can be seen from Table 1.

Facilities

The construction of physical facilities at SFU continues to lag behind enrolment growth. Overall, the University has approximately 87% of the space expected for an institution with our enrolment [SFU Facilities Management, 1994]. However, the space shortfall is spread unevenly, with the largest deficits occurring in Student and Central Services (37%), Recreation/Athletics (39%) and the Library (19%). The shortfall in library space is also reflected in the library collections: averaged over 1987-1990, the SFU Library held 126 volumes per student [Canadian Assoc. of Research Libraries]. Because the Library's acquisition budget has been increased by just under a million dollars in the past two years, there is a need for more storage space for text-based material.

To summarize, the graduate and research activities at Simon Fraser University on a per capita basis are near the mean of the comparison group, as measured by a suite of conventional indicators. However, we fare less well by measures that are applied to an entire institution, ignoring its size and age. In contrast, there is an array of quasi-meaningful undergraduate-program indicators, and by several of these, the undergraduate program at SFU consistently ranks in the top ten in Canada.

3. ISSUES IN GRADUATE STUDIES

3.1 Enrolment

The graduate student population at SFU is substantial, but not large by international standards. At the most highly regarded US research universities, graduate students make up a higher proportion of the student body, in some cases more than 60%, than they do at any Canadian university. Among the many reasons for our current enrolment level:

- our program mix does not include several disciplines, such as health sciences, that are able to support a graduate student population through external research grants and contracts
- many of our faculty have been hired recently to accompany undergraduate enrolment growth, and these individuals are just beginning their research careers
- until recently, BC has not had a system of exclusively undergraduate degree-granting colleges, some of whose graduates would seek an advanced professional or research degree at a graduate institution.

The number of FTE graduate students that the provincial government currently funds SFU to handle (1379) is less than our actual graduate enrolment (1679). There is no indication that the province will increase the level of funded graduate students. To what extent are these "extra" 300 students unfunded? PCUP believes that SFU should estimate the costs and benefits associated with graduate programs, but emphasizes that performing a cost/benefit analysis will be challenging because many resources play a dual role in graduate studies and research.

It is important to distinguish between the funds that the University receives to provide graduate education, and the funds which the University spends from its teaching budget for the tutorial system in which many graduate students are employed. The provincial government funds library resources, research facilities and faculty supervisory time for the delivery of graduate degrees. Some graduate programs at SFU recover much of their nominal cost through tuition. While the financial situation could be better, the costs to the University for educating and supervising our current graduate student population approximately balance the resources available to the University. The income level of graduate students is

a separate issue, and is dependent on the availability of scholarships, research grants and contracts, and teaching assistantships. It is important that SFU maintain its extensive use of undergraduate tutorials not only because it is good pedagogical practice and training for future teachers, but also because it provides a source of income for graduate students. Equally important issues in graduate studies, to which we return later, are the stability of support and the quality of research facilities.

In PCUP's discussions with the SFU community, the prime concern expressed about the graduate programs is the maintenance of quality. A question frequently raised in our discussions is whether program quality increases with program size. That is, should SFU aggressively increase the number of our graduate students, if such an increase would improve the quality of the students? We acknowledge the difficulty of finding acceptable indicators of program quality or scholarly achievement to answer this question. Further, the limited data available to address this issue use the number of faculty as an observable, rather than the number of graduate students, although it is commonly found that the number of graduate students is proportional to the number of faculty in a given program.

As a measure of the quality of faculty research, we fall back on the conventional, but not always appropriate, measure of research funding per faculty member, segregated by granting agency, but averaged over a large number of faculty. In the 19-member comparison group, there is very little correlation between the number of faculty eligible to receive grants and the per-capita funding that these faculty are awarded. We conclude from this indicator that increasing the number of faculty or graduate students in a given program will not necessarily lead to an increase in the quality of the program. However, we are convinced that there are graduate activity thresholds below which programs are not viable, and we outline these thresholds in Sec. 3.2.

We deal later in this paper with strategies for program excellence, and with new program directions that the University might pursue. PCUP anticipates that graduate enrolment will continue to rise as SFU faculty establish their research careers and as the BC postsecondary system evolves. However, growth in our graduate programs will be restricted if SFU's budget fails to reflect the demand for graduate education or if, over the longer term, the

government creates new graduate institutions. Further, research activities at all universities will come under increasing pressure from reductions in federal grants and contracts.

At present, the fractional graduate student population at SFU is slightly lower than the Canadian average, which includes the undergraduate populations of institutions with no graduate programs at all. In response to the establishment of many new undergraduate institutions in BC, SFU should differentiate itself with the provision of more graduate professional and research programs. Based on the growing demand for graduate programs from a larger provincial undergraduate population, graduate students ultimately should represent 15-20% of the total student population.

Recommendations:

A.1 Although graduate enrolment is in rough equilibrium with the available financial resources to the University, SFU should encourage the development and expansion of high-quality graduate programs. SFU should not force the growth of graduate programs while sacrificing quality; however, if the graduate student population fails to increase modestly to 15% of the total student population by the year 2000, the University should re-evaluate whether policies are required to raise graduate enrolment.

A.2 The University should determine the approximate costs and benefits of graduate programs.

A.3 Graduate admission decisions should continue to be made at the departmental level, but departments and Faculty deans, together with the Dean of Graduate Studies, should work together to maintain an enrolment level that is commensurate with the available financial and personnel resources.

3.2 Program Quality

Issues of quality control at a university can arise in a variety of contexts, including standards used for hiring faculty, for admitting students and for awarding degrees. As summarized in Section 2, SFU does moderately well in attracting national scholarship-holders. In "exit surveys" of graduate students, the quality of graduate supervision is ranked highly. Nevertheless, we must maintain the value of an SFU degree through applying strict admission standards, monitoring student progress and guarding against inadequate

supervision. We must also make sure that the quality of our graduate courses is of the same high standard as our undergraduate courses.

The intensity of graduate supervision varies widely across the University; according to the needs of the discipline, some faculty meet daily with their students and involve them in their research as collaborators, while others meet infrequently. National granting agencies place an increasing emphasis on the training of highly qualified personnel by methods that frequently involve collaborative interaction between graduate student and professor. Intense collaboration can be a source of conflict.

At SFU, mechanisms are already in place, but not always used effectively, to monitor student progress in a degree program and to intervene in the supervision process if necessary. Student/supervisor contracts have been proposed as a means of dealing with unsatisfactory progress or inappropriate supervision. PCUP encourages the exploration of less legalistic alternatives to contracts which, together with existing mechanisms, can be utilized to resolve difficulties in student/supervisor relations. Some institutions deal with the heterogeneity of graduate student supervision by the use of a formal School of Graduate Studies. Independent of the merits of a formal school, PCUP believes that such a structure cannot be imposed retroactively upon SFU at this stage in its development.

The graduate programs in many departments are not large, resulting in small course enrolments at the graduate level. The strategy taken by some departments in dealing with low enrolment courses is to offer a course with both an undergraduate and graduate course number. While PCUP does not wish to place barriers against qualified senior undergraduate students enrolling in graduate courses, we are concerned that dual-labeled courses may lead to a dilution of course content that is not consistent with a high quality graduate education. Graduate courses must be taught at a level which is significantly beyond that of undergraduate courses.

An SFU Senate subcommittee has recommended that teaching credit be reduced for low enrolment courses, which means that better methods must be developed for teaching small courses while maintaining high standards of instruction. New instructional methods for graduate courses might involve

- a higher level of graduate student participation in the preparation and delivery of course material
 - more joint course offerings with other universities
 - a greater sharing of teaching responsibility among several faculty.
- Faculty members might be expected to participate in such courses routinely, as part of their regular research and graduate studies responsibilities, *without receiving credit for teaching a full course*.

Graduate program quality is evaluated regularly at SFU. However, it is PCUP's impression that comparisons of our programs against national indicators are hampered by a lack of appropriate data. As we state elsewhere in this paper, it is important that indicators be developed to assess the quality of research in an academic unit and the excellence of the graduate programs they offer. Indicators should not be exclusively academic (i.e., number of scholarship winners) but should reflect the desirability of entry to the program (through the number of applicants) and the success of graduates in obtaining employment upon degree-completion.

The membership of review panels should have strong representation from experts in the discipline. In addition, there should be representation from the constituencies that employ graduates of programs. While the assessment should evaluate the quality of the faculty, staff and students in a program or academic unit, it should also evaluate:

- availability of graduate courses
 - frequent colloquia by researchers external to the university.
- Most graduate students should have at least five courses available to them at the Master's level and three at the doctoral level. In order to ensure timely completion of degrees, a program should offer at least three graduate-level courses per year. Once a program has been assessed, the recommendations of the review should be acted upon.

Lastly, there is a general reluctance, except in times of financial stress, to wrap up programs that are of low quality. If a program is of low quality as measured by any criteria involving the personnel, the activity level as evidenced by courses, or the availability of colloquia, and if the program cannot meet the minimal criteria for continuance, then it should:

- seek amalgamation and restructuring with another SFU program, or
- seek amalgamation with another program in BC, or
- be closed.

Recommendations:

B.1 Strengthen student recruitment to place our success at attracting scholarship-holders (per faculty member) in the top five in Canada.

B.2 Place graduate programs among the key components of departmental reviews and ask reviewers to take account of current and prospective financial resources in shaping their recommendations. The assessment should consider program demand, employment of graduates, graduate course availability and existence of weekly colloquia.

B.3 Improve the database to compare quality of graduate programs at the national level; annually publish a performance report according to an acceptable set of indicators based on national comparisons.

B.4 Make the academic level of all graduate courses substantially higher than that of fourth year courses; find alternate methodologies for offering graduate courses with limited enrolment, including joint offerings with other departments or institutions.

B.5 Set minimum criteria for the continuation of graduate programs based on the assessment procedure of B.2 and B.3; develop mechanisms for closing low quality programs, including amalgamation with other programs at SFU or other institutions.

3.3 New Program Directions

Over the next decade, we expect that enrolment in conventional research-based degrees will continue to grow if the number of faculty available to supervise research rises. However, the external funds available to support graduate students are unlikely to be equally available across the University. The realities of granting agency budgets are that the research funds available from SSHRC are significantly less than those from NSERC or the Medical Research Council of Canada (MRC). While PCUP is confident that SFU professors will maintain their funding levels in spite of cutbacks to the federal granting agencies, we expect that the number of externally funded research positions for graduate students will continue to mirror the size of the faculty complement, whether it increases or decreases.

However, PCUP anticipates rising demand for course-based professional masters degrees. We note that UBC may also seek to

augment its professional masters programs. Such degrees may have lower capital costs if they are less demanding of laboratory facilities than research degrees. However, professional degrees are very demanding of the Library and of faculty expertise in providing rapidly evolving curricula. Potentially, professional courses may have higher classroom enrolments than traditional graduate courses. Because professional degrees generally have a higher economic payback to the degree-holder, it may be possible to recover a higher fraction of their costs from tuition revenue. New professional programs do not need to be extensions of undergraduate programs.

Because of their relatively large enrolments, it is straightforward to estimate demand for undergraduate programs by using national demand indicators, and to identify areas into which SFU potentially could expand. At the graduate level, it is much more difficult to identify specific subject areas for expansion, both because the enrolments are smaller and because topical research areas evolve more rapidly. PCUP believes that there are considerable opportunities in interdisciplinary research areas, such as

- software and systems engineering
- management of technology
- cultural studies
- public policy analysis
- interdisciplinary programs in biology, chemistry and physics
- health-related programs.

There are also opportunities in new approaches to traditional disciplines, an example being SFU's Masters in Liberal Studies.

Partnerships with other postsecondary institutions should be encouraged so that effective use can be made of the financial resources available for new programs. Further, it may be appropriate to extend partnerships to public sector institutions and private sector organizations, with the aims of broadening the instructional environment, utilizing a more diverse base of instructional personnel, and heightening the relevance of the programs to the marketplace.

SFU has a strong Co-operative Education program at the undergraduate level, and a corresponding administrative infrastructure that includes placement officers and advisory boards with excellent representation from employer groups. As part of its undergraduate report, PCUP has recommended that the co-op program be expanded and that the trimester system be exploited in

support of co-op. The existing infrastructure could be used to identify and establish new co-op programs at the graduate level as well. This possibility has been discussed with the Co-op Advisory Council, which strongly supports expansion of graduate co-op programs, especially at the masters level. Several models for graduate-level co-op include:

- extensions of undergraduate programs
- one-of-a-kind multiterm projects in-house
- ongoing projects involving SFU faculty.

While much of the infrastructure needed for graduate co-op is already in place, greater faculty involvement will be necessary to help identify and supervise suitable projects.

The federal research councils originally were established, in part, to encourage research activities related to the Canadian economy and to provide a research base to help keep Canadian business competitive. Research councils in all countries currently are placing increased emphasis on this latter aspect of their mandate. Making the university research community aware of the opportunities for collaboration with Canadian companies, and making companies aware of the capabilities of our students, staff and faculty, requires good communication. Among the many components that could aid this communication are:

- significantly enhanced Co-operative Education at the graduate level and research internships for graduate students
- departmental/faculty advisory boards chosen from private and public sector employer groups
- increased exchange of personnel through (i) industrial study leaves for faculty and (ii) adjunct professorships for researchers outside of the university environment
- an enhanced profile for University/Industry Liaison Office activities
- greater discussion of SFU research in the internal and external media.

While the traditional research and professional degrees remain the core activities of a university, there is a growing trend for companies to provide life-long learning opportunities for their employees. In some cases, these opportunities involve the provision of degree completion programs on a contract basis. SFU participates in such degree programs and should continue to do so. Strict control of program quality must be a condition of our participation in contract-based degrees.

Recommendations:

C.1 Expand the base of professional degrees available at the masters level.

C.2 Expand Co-operative Education in graduate degrees.

C.3 Establish research internships for graduate students in locations external to SFU; placements would probably have to be for eight months, and would depend heavily on co-operation between faculty member and placement employer.

C.4 Establish advisory/liaison councils of private and public sector employers at the departmental/Faculty level (see E.3 for other aspects of this recommendation).

C.5 Encourage adjunct appointments for external researchers.

C.6 Recognize that financial support from the university may be necessary for some graduate courses that are equipment-dependent.

C.7 Explore the possibility of additional joint graduate programs with other provincial postsecondary institutions using the model developed for the Ph.D. program in Philosophy.

C.8 Encourage interdisciplinary graduate programs, such as Engineering Physics, Communication and Business, etc.

C.9 Consider partnerships with specific corporations for providing graduate degree-completion or upgrading programs on a contract basis.

3.4 Graduate Student Funding and Tuition

There are several aspects to the financing of graduate education. Funds received by the University from the provincial government and from graduate student tuition, provide for graduate library resources, graduate office and laboratory space, and faculty supervisory time. Independent of these funds, graduate students may obtain financial support from the University through scholarships and bursaries, through research assistantships, or through participation in the teaching activities of the University.

There is considerable variation within SFU as to the provision of financial support for graduate students. In the MBA and EMBA programs, no financial support is provided by the University other than scholarships and bursaries. In other disciplines, students are guaranteed financial support through teaching and research

assistantships. PCUP has heard repeatedly that teaching assistantships are a vital component of graduate student support and training, and that the number of assistantships should not be decreased. PCUP concurs with this view and argues for the continued use of an extensive tutorial system in undergraduate courses on pedagogical grounds, recognizing the benefits that teaching assistantships provide graduate students. Some departments may wish to provide a package of financial guarantees for new, appropriately qualified graduate students in their first year of study, based in part on the availability of teaching assistantships.

The provincial government does not fund universities by an explicit formula that takes into account a student's program, year in program etc. However, the incremental funds made available for enrolment growth are granted on a per-student basis that nominally assigns a contribution of about \$7000 per undergraduate and \$17,000 per graduate student, averaged over all disciplines, reflecting the costly library resources and space resources required for graduate students. Further, faculty time required for graduate student supervision and graduate course delivery is certainly larger than the approximately 1 hour per week of faculty time devoted to course preparation and delivery for the average full-time undergraduate student. The factor-of-two ratio between the educational costs of graduate and undergraduate students implied by these figures may not be wildly incorrect. Tuition per FTE at SFU is about \$2300 per year for both graduate and undergraduate students, so that undergraduate students probably pay a higher fraction of their nominal average program costs than graduate students pay.

PCUP believes that the fraction of educational costs paid by undergraduate and graduate students should be roughly comparable on average. Although it will take some effort to accurately estimate the cost of graduate education, tuition for graduate students averaged over all programs could as much as double if the crude analysis above proves to be correct. It may be necessary to spread any tuition increases over several years so that our fees are not uncompetitive with other institutions. Further, the financial support for graduate students must be placed on a firmer basis, as we discuss elsewhere in this report. Finally, because there is strong variation in the payback to the degree-holder for obtaining an advanced degree, it may be appropriate for those students in high-demand degrees to pay a larger fraction of their educational costs than those students who work in areas of lower demand, but of equal value to society.

SFU should develop an extensive scholarship and bursary program, aimed in part at graduate students and financed by sources other than tuition. In particular, the development of those SFU lands not required for academic purposes presents an excellent source of funds that PCUP believes should be used largely for scholarships and bursaries. The increased income derived from graduate tuition should be put towards graduate education resources that are available to all students, such as the Library, visiting scholars programs etc.

Recommendations:

D.1 As needed, provide adequate financial packages for graduate student support during their first year at SFU to make our admission offers competitive with other institutions.

D.2 Retain/expand the teaching assistant budget.

D.3 Review the approximate costs involved in graduate courses and supervision and make the fraction of educational costs covered by tuition approximately the same at the undergraduate and graduate degree level.

D.4 Institute differential fees for those graduate degrees that deliver a strong economic payoff to the degree-holder (this is already being implemented for the EMBA program).

D.5 Use any increased graduate tuition revenue to improve the graduate research environment, including the Library, visiting scholars programs etc.

D.6 Seek greater external research funds and private endowments for graduate student scholarships; use part of the funds generated from the non-academic usage of SFU lands for graduate scholarships.

D.7 Maintain a balance between the graduate student population and the resources available for graduate education.

D.8 Negotiate with TSSU to permit the offering of TA-ships on a yearly basis to incoming and continuing graduate students who are in good academic standing and who have appropriate teaching skills.

3.5 Operational issues

Many operational issues have been raised in the discussions that PCUP has had with the SFU graduate community. While important, most of these questions do not fall into PCUP's mandate dealing with strategic planning. However, two of these issues have been raised repeatedly and we therefore bring them to the attention of the University.

There are many examples in which trimester registration at the graduate level results in substantial paperwork. PCUP does not favour the abandonment of trimester operation at the graduate level, particularly if graduate Co-operative Education is expanded or graduate research internships become common. However, a thorough review of all existing paperwork and procedures should be performed by academic units and the Dean of Graduate Studies. Efforts should be made to

- contain paperwork within those academic units primarily responsible for the enforcement of regulations
- shorten deadlines for some aspects of the thesis defense schedule
- increase the usage of electronic forms
- complete the implementation of teleregistration for graduate courses.

A second set of operational issues deals with the graduate student environment. First, there is a perceived need for graduate student orientation: some incoming students are unaware of what a research degree entails, while international students may need to be informed of the expectations of the Canadian university system. Second, it is felt that a graduate student meeting place needs to be established in order to foster a better sense of community. There also needs to be increased on-campus housing available to graduate students, recognizing that:

- (i) graduate students are drawn from a broad national and international background
- (ii) because of their typical age and marital status, graduate students have a need for family accommodation.

4. RESEARCH ISSUES

Among the industrialized countries, Canada does not have a strong record of supporting research and development. The total

number of personnel involved in research and development, relative to the population base, is perhaps one-half to one-third that of advanced industrialized countries. Unlike many countries in the OECD (Organization for Economic Co-operation and Development), much of our national research effort is geographically located at the universities.

The support provided to university researchers includes both time and money. Considering the typical teaching terms of 15 weeks, most Canadian university faculty have at least 4 months time, sometimes spread unevenly throughout the year, to pursue their research activities, in addition to research time provided through sabbatical leave. Financial support for research projects is generated largely from sources outside of the university. The total amount of external funds awarded to SFU for research has grown for many years, in step with the faculty complement. However, as the budgets of federal granting agencies are reduced, provincial grants and commercial contracts will constitute a greater fraction of academic research funds. Competition for these resources will be keen, and appropriate infrastructure should be in place at SFU to enhance our success rate in securing such funds.

Faculties should encourage an appropriate balance of fundamental and applied research, in part to take advantage of the diversity of funding resources. However, PCUP does not believe that it is desirable for the University to place priorities on the nature or orientation of research that professors may wish to pursue: the most important issue is the quality of the research. We also see no need for the university to expand the internal financial support for ongoing research: salaries are the largest components of university budgets, and an increase in financial support for research projects most likely would result in a reduction in the number of faculty and staff.

SFU contributes to faculty research through the adjustment of faculty workloads, the provision of some research facilities, special programs for beginning faculty, and a flexible study-leave policy. It is especially important for the University to provide appropriate resources to new faculty to help them establish their research careers. The main research facilities financed by SFU on a continuing basis are computing and the Library. The impressive improvement in workstation performance has almost eliminated the need for the University to maintain central computers for research use; however,

campus networking requirements are soaring. The Library will continue to play a pivotal role in research; its collections and accessibility to external collections need to be strengthened.

4.1 Research Funding

The financial resources required by faculty to support their research varies by discipline and, occasionally, by age of the researcher. The different *modi operandi* in which faculty perform their research include:

- (i) independent work, largely without graduate students or external grants
- (ii) limited collaborative work with graduate students, the students themselves deriving little financial support from their supervisor
- (iii) extensive collaboration with graduate students who are partially supported by substantial research grants and contracts awarded to the supervisor.

In many disciplines, perhaps half of the external funds raised for research goes to salaries - the support of graduate students, postdoctoral fellows and other staff. Research in science, applied science and engineering may also require substantial funds for equipment.

Granting agencies continue to emphasize collaborative and applied projects. Increasingly, research projects that are dependent on personnel or equipment for their successful conclusion, must look towards collaboration with industry and/or other public sector institutions. A substantial time commitment may be required for a researcher to perform the initial administrative overhead to apply for a grant in competitions such as the Networks of Centres of Excellence program. In spite of the low odds of success, SFU researchers must enter these competitions, and the University must be prepared to help groups of faculty deal with the administrative hurdles associated with applying for such sources of funds. During merit reviews, academic units should acknowledge the administrative overhead borne by faculty in particularly onerous competitions.

International agencies also provide research funds. The North American Free Trade Agreement, for example, has a research component to it from which SFU benefits. Of course, international funding also means international competition. Among their many duties, the Office of Research Services and the University/Industry

Liaison Office play important roles in keeping faculty aware of regional, national and international sources of research funds.

Applied and commercial research contracts are common at universities and the diversification of the research base into applied areas probably is healthy. Among its many benefits, applied research enhances our communication with public and private sector organizations. However, we need constantly to remind ourselves of our responsibility to undertake and support research that advances fundamental knowledge.

Issues such as confidentiality and conflict of interest arise more frequently in contract research than they do in fundamental or undirected research. Potential dangers in becoming overly dependent on commercial sources of research funds are that long-term or controversial questions are avoided. These difficulties have been recognized by the University, and have been addressed through university policies.

Finally, there is the question of appropriate chargeback of university overhead for contract research. SFU has recently reviewed with Canadian and US granting agencies its overhead costs, and it has been agreed that the charges fairly reflect the costs to SFU of administering contracts. As the contract research component of the University's budget becomes more important, SFU should attempt to obtain a profit from such research and distribute part of this profit to other University efforts which are deserving, but not as well funded.

Recommendations:

E.1 Encourage a healthy mix of pure and applied research within each Faculty in order to diversify funding sources in anticipation of reduced contributions from federal granting agencies.

E.2 Continue to develop administrative infrastructure to support SFU faculty participating in large collaborative research projects.

E.3 Develop community and industry advisory councils to identify research opportunities at the departmental level, as part of the advisory committee structure recommended in Rec. C.4; coordinate the membership of such committees through the Co-op office and UILO in order to increase the likelihood of employer participation.

4.2 Support for Scholars

The scholarly aspects of a faculty member's workload at SFU emphasize research and teaching in equal measure. Promotion to the rank of full professor requires that a faculty member have a nationally or internationally recognized profile in scholarly work. Providing research time to faculty is not without cost to the University. The budget given to BC universities by the province is driven primarily by undergraduate enrolment, and the average funding allocated per FTE undergraduate is about the same for colleges as it is for universities. University professors have far more students in each of their courses, as they teach only about half the number of contact hours of a college instructor.

How can the merit system identify and reward research excellence? The knowledge generated through research varies in its potential importance and applicability. To take two extreme examples from our spectrum of knowledge-generation activities: should we value more highly an archival piece of fundamental knowledge or a patented piece of knowledge with technological importance - recognizing that both examples may have a finite shelf life? As the research activities of the university diversify, the merit system of faculty rewards must take into account more than the traditional accomplishments measured by publications and grants. Further complications arise as faculty engage in more applied or commercial research. Should the merit system and the university salary structure reward the professor who uses publicly-funded research time to

- write a book on contract, particularly if the subject is outside of the professor's academic work?
- file a patent that generates royalties?
- perform contract consulting?

Policies have been developed to deal with some aspects of the income gained by these activities, but the role they might play in the consideration of promotion and tenure is, and should continue to be, debated.

One of the central questions in this debate is: what is the scholarly mandate of a publicly-funded institution? In PCUP's view, scholarship includes:

- the discovery, application and disclosure of knowledge through the traditional means of publications and patents, and peer-reviewed performances and exhibitions
- the transfer and diffusion of that knowledge through teaching and curriculum development.

We recognize the various forms that research activities may take, including consulting and contract research. However, a faculty member should be active in scholarship while on University salary. As careers evolve, a faculty member's commitment to active or traditional scholarship may vary. Faculty may also wish to take a larger role in community service on behalf of the University. There are already mechanisms in place to adjust some of the workload and rewards to faculty for exemplary teaching and/or research, and some units, such as the Department of Communication, have implemented their own procedure for workload evaluation.

Special attention needs to be paid to newly hired faculty. Given the competition for research funds in some disciplines, young faculty may need extra support from their more senior colleagues in their first year at SFU. This support may take the form of a reduced teaching load, or a start-up grant, or freedom from committee work. The amount and nature of support needed by young faculty will vary by discipline. Increased time for research should be available only during the first year of an appointment, not during the subsequent years leading to a tenure decision.

Recommendations:

F.1 Adjust faculty workloads to reflect the quality of, and commitment to, research supervision together with undergraduate responsibilities; allow for recognition of service to the university by faculty and staff.

F.2 Develop means of assessing the quality of scholarly work in areas such as curriculum development. The results of scholarship in teaching should be placed in the public domain and be available/useful to colleagues.

F.3 Provide a reduced teaching and administrative workload in the first year (only) of a faculty member's appointment; the amount of the reduction would be determined by a comparison with peer institutions and may vary with the norms of the discipline.

4.3 Research Facilities

In our meetings with SFU graduate students and researchers, two facilities issues have come up repeatedly: office space and library resources. The shortfall in office space, by national standards, is measurable, but not large. In contrast, the shortage of athletics and recreation space and study space is severe and deserves the University's attention. Space for student services is also in high demand, although this situation should ease with the opening of the new Student Services Building.

Graduate students need on-campus space if they are to be part of the instructional staff or a collaborative research group. Given the increasing use of technology in teaching, communication and research, conventional office space may not be the most appropriate means of meeting this requirement for on-campus space. In some departments, shared office space is used for both faculty and graduate students who are not on campus five days per week. A review of the space inventory at SFU is currently underway, and will indicate the priority that the university should assign to new construction.

Libraries are a central component of the university research environment. The publication of research results has taken on epic proportions in the past decade: the yearly volumes of a major journal which once could be held in one hand, now take up a meter of library shelf space. Much of the fundamental knowledge contained in these journals is archival - it has been performed to augment our knowledge base but it may be known to, or important to, only a small circle of researchers. Some learned societies are responding to the publication explosion by placing their journals on-line and developing software to search their cumulative on-line databases.

All research fields need up-to-date journal collections in their disciplines. Some need a variety of journals in related fields, while others need large historical collections. Library acquisition rates at SFU are close to the national norms, but the holdings per student are near the lowest of the comparison group of institutions identified in Section 2. This reflects both the age of SFU and the shortage of physical space in which to house collections. However, almost a million dollars has been added to the Library's acquisition budget in the last two years, and the increasing size of the Library's collections may force a physical expansion of the Library within a few years.

While PCUP believes that SFU should develop nationally significant collections in some disciplines, it is perhaps more important to recognize the trend in journal publication towards electronic distribution. Technologically advanced libraries will soon have easy access to vast collections of on-line material worldwide. The SFU Library must have such electronic access if it is to be a significant research library. It must also have good collections of conventional print material, such as monographs, used frequently by undergraduate and graduate students. Further, not all collections around the globe will be on-line in the near, or even foreseeable, future, so that both faculty and graduate students will continue to require funds to travel to off-campus libraries.

Recommendations:

G.1 Identify the kind and amount of office/meeting space required for teaching assistants.

G.2 Identify a few high priority areas in which the Library should seek to build nationally significant collections. If these collections are in areas that are candidates for electronic distribution, SFU should make a strategic decision to be the national on-line server. Collections could include audio and video material, such as a film and image library.

G.3 Encourage departments to develop research specialties in order to have nationally competitive facilities and library holdings.

G.4 Accelerate the Library's efforts to obtain extensive access to appropriate electronic collections as they become available.