

## **DEPARTMENT OF APPLIED STATISTICS AND OPERATIONS RESEARCH PROGRAM REVIEW COMMITTEE REPORT**

The Department of Applied Statistics and Operations Research prepared a self study following program review guidelines. A two-person external review team (U. Narayan Bhat of Southern Methodist University and Karen Kafadar of the University of Colorado at Denver) visited the campus; reviewed the self study; interviewed unit personnel, university administrators, and graduate students; and submitted an external report. The Program Review Committee studied all written materials. The Committee liaison for the Department discussed the self study with the department chair and faculty. The Committee discussed its preliminary findings with the Dean of the College of Business Administration. This document reflects the Committee's findings and recommendations.

### **SUMMARY OF THE SELF STUDY**

#### **Introduction**

*Mission.* The Department's mission focuses on teaching quantitative reasoning at the undergraduate and graduate levels; conducting research in statistics and operations research with an applied focus; and providing statistical and operations research consulting to the College, University, and external community.

*History.* The Department was established in the College of Business Administration in 1978. The last program review was completed in December of 1999. At the time, the Program Review Committee members felt the Department offered valuable services to the University, but was not convinced that the Department was the best place to invest limited resources of the College. The PRC recommendations are below in italics. The Department's responses are below each recommendation:

1. *Write a mission statement that identifies the centrality of the Department to the College.*

In response, the Department wrote a mission statement confirming its centrality to the College (Appendix B of the self study).

2. *Attend to curricular issues raised by the external reviewers.*

The Department made a number of modifications to enhance the curriculum (p. 7 of the self study).

3. *Develop a programmatic focus that creates a synergy between the AS and OR aspects of the program.*

In response, the Department developed a statement on the role and mission of operations research (Appendix D of the self study).

4. *Develop a departmental research plan to be reviewed and approved by the Dean and Vice Provost for Research.*

The Department developed a five-year research plan (Appendix C of the self study). This was approved by the Dean and Vice Provost.

5. *Establish contacts and collaborations with area businesses that would provide the foundation for an Institute of Applied Optimization and Statistical Analysis (as recommended by the external reviewers).*

As evidence of community outreach, the self study (p. 10) points to on-going relationships with Consolidated Biscuit, a Microsoft Excel workshop for mid-level executives, and the initiation of discussions with area high schools. The Department seeks advice from the PRC on the need to create an Institute.

6. *Move toward bringing the MSCS/OR degree within the Department.*

The self study notes that they “reluctantly” abandoned the idea of moving the Operations Research master’s degree out of computer science and into the Department. This was in response to the results of a cost-benefit analysis of moving the degree out of computer science (p. 8-9), along with predicted opposition from the Ohio Board of Regents.

7. *Develop further collaborations with Mathematics and Statistics on the MSAS degree and development of the Statistical Consulting Center.*

In Spring 2005, the faculty met with statisticians from Mathematics and Statistics to discuss the MSAS program. They discussed the possibility of creating a single website for statistics education at BGSU. All agreed that more frequent meetings would be useful.

### **Description of the Unit**

*Programmatic and curricular offerings.* The Department plays an important role in the education of students in the BSBA program through three core courses (STAT 211, STAT 212, and OR 380), and offers two foundational courses (STAT 601 and MBA 601) in the MBA program. In collaboration with the Department of Mathematics and Statistics, the Department offers a master’s degree in applied statistics (MSAS). The Department also offers four of six required courses and several optional courses in the master’s program in Computer Science with a concentration in Operations Research (MSCS/OR).

*Faculty resources.* In addition to seven tenured or tenure-track faculty, the Department has three full-time instructors. Since 1993, the department's maximum FTE was 12. All tenured or tenure-track faculty carry a standard teaching load of six courses per year, although some receive course releases for administrative responsibilities. Full-time instructors teach eight courses per year.

*Graduate assistant resources.* Most students in the MSAS and MSCSOR programs receive financial assistance. The Department receives about five half-time GA's for the MSCSOR program and 12.5 half-time GA's for the MSAS program, which includes four half-time GA's to partially compensate for the release time of the Director and Assistant Director of the Statistical Consulting Center.

*Staff resources.* The Department has been assigned one secretary, who works full time during the academic year and has been working part time during the summers.

*Student credit hour production.* The Department continues to average around 280 SCH/FTE per semester. This is estimated at over 300 SCH/FTE per semester when reductions for the Director and Assistant Director of the Statistical Consulting Center are taken into account.

*Recruitment and retention efforts.* Graduate students are recruited through mass mailings, listings in relevant affiliation program guides, and web links. Most students complete the program in two years or less.

*Facilities and equipment.* Faculty have "relatively new" computers. General purpose software is available through University licenses.

*Information resources and services.* The Department has suffered due to discontinuation of many journals. This problem is "somewhat mitigated" by services available through Interlibrary Loan.

*Financial resources.* There are large inconsistencies concerning the college's estimate of operating costs and Institutional Research's estimate. Personnel expenses have shown modest growth over time. Extramural funding appears to be non-existent, with the exception of contracts for workshops and statistical consulting.

## **Self Evaluation**

*Faculty quality and productivity.* During the period between 1999 and 2005, faculty produced an average of 1.1 refereed journal publications per faculty per year and 1.45 conference presentations per faculty per year. The self study reports that "many of the faculty publications have appeared in highly rated journals," although they do not indicate the actual numbers. Dr. Yeh has been appointed Associate Editor of the journal, *The American Statistician*, considered an "A" quality journal by the College's journal ranking system. To date, the Department has had no success in securing grant funding, but they are optimistic about the future.

*Student entry attributes.* The average GRE scores (Verbal + Quantitative) of students admitted between 1998-2004 ranges from 1160 to 1375. There appears to be a steady increase in the quantitative scores of those entering, while the verbal scores remain similar from year to year. The average undergraduate GPA is 3.33. This has steadily increased from year to year.

*Assessment of student learning outcomes.* The learning outcomes for the MSAS and MSCSOR programs are well-defined and matched to assessment method (e.g., research project, oral presentations). A survey of alumni (Appendix N) indicated that graduates believe they were adequately prepared for their careers, and were pleased with their academic experience. Alumni were especially pleased with faculty advising. As a result of the assessment, the Department has enhanced its course offerings to include desired classes such as Data Mining (STAT 680) and Statistical Consulting (STAT 687).

*Service.* By far, the major service activity of the Department is in the administration of the Statistical Consulting Center. This has been recognized by the Faculty Senate through a Unit Achievement Award in 2001. The Department offers a service course to the University entitled Using Statistics (STAT 200). Enrollment in the course currently stands at about 100 each semester. Individual faculty members are highly involved in service to the profession.

*Comparative advantage and program distinctiveness.* The MSAS degree is one of three programs in Ohio in applied statistics. The MSCSOR program, which offers a combination of computer science and operations research, is the only one of its kind in the United States. The Bureau of Labor Statistics identified dual graduate degrees in operations research and computer science as especially attractive to employers.

*Demand.* Enrollment in all STAT courses has been healthy and steady over the years with average section size ranging from 14 to 26.5. There has been a reduction in MSAS students taking the operations research cognate, which has resulted in a decrease in the average section size of OR courses. The headcount for MSAS and MSCSOR programs has remained steady over the years. Demand for graduates has remained strong.

*Connection to the mission.* The Department plays a central role in the undergraduate and graduate programs in business. Its interdisciplinary course offerings, along with the Statistical Consulting Center, enhances academic programs throughout the University.

*Financial considerations and adequacy of resources.* With successful recruitment of a statistician in 2006, the faculty and staff resources available are adequate. Stipends for the graduate programs are too low to compete with other Ohio universities for the best students. The self study reports a "severe" shortfall in funding for faculty travel. The current limit of \$1,000 per conference and \$1,500 per year per faculty has not changed over the last ten years.

### **Unit planning (next seven years)**

*The planning process.* The faculty meet biweekly to discuss all matters relevant to the Department. The focus is on continuous improvement.

*Goals, strategies, and timetables.*

- a. Continuous improvement of the BSBA, MBA, and MOD programs. Enhance scheduling flexibility for students by offering a 5-credit STAT 210 as an alternative to STAT 211 and STAT 212. An experimental version of the course would be offered beginning in Fall 2006, and the course would be offered on a permanent basis starting Fall 2008. Other modifications to STAT 211 and STAT 212 are being considered, including offering them on line by Summer 2008.
- b. Continuous improvement of MSAS program. Begin offering a statistical consulting course in 2007-2008. In Fall 2006, begin exploring the possibility of adding courses in biostatistics, data mining, and statistical computing.
- c. Continuous improvement of MSCS/OR program. Expand offering in operations research by 2007-2008.
- d. Increase efforts to recruit students to the MSAS and MSCSOR programs. Host an open house in 2007-2008.
- e. Actively pursue outreach or scholarship of engagement activities to offer expertise of ASOR faculty to the community and local industries. Continue offering workshop on data analysis, and offer other short courses and workshops beginning 2007-2008.
- f. Improve student/alumni services. Establish an alumni listserv by the end of 2005-2006. Develop an exit survey to be administered to all graduates starting with 2006-2007.

*Questions for the external team.*

- a. How can the MSAS and MSCSOR programs attract fee-paying students and/or generate funding from external sources (students are currently supported by assistantships)?
- b. Are there suggestions for increasing enrollment of U.S. students?
- c. Are there suggestions for attracting minority students?
- d. Although it is possible for the Statistical Consulting Center's guidelines to be revised to solicit external projects, such a change is bound to create a conflict between providing service to the university community and serving as a source of revenue. Are there suggestions on whether this is a wise use of the Center and, if so, how this can best be accomplished?

### **RESULTS OF PREVIOUS REVIEWS**

As noted earlier, the previous PRC report questioned whether College resources should be invested in the Department. In response, a mission statement was developed, along with a five-year research plan and a statement on the role and mission of operations

research. In response, the Dean of Business Administration affirmed that the department mission is central to the College and warrants additional faculty resources.

## **SUMMARY OF THE EXTERNAL REPORT**

### **Overall Assessment**

The external reviewers believe the Department is “a well run department working constructively within the College of Business Administration.” As such, the review team believes that the Department should be continued with proper support from the University. The review team believes the Department could be strengthened, however, by establishing an M.S. program in the Department, and expanding the scope of the Center.

### **Strengths**

The external reviewers recognized the high quality of the training in applied statistics and operations research, the collegiality of the Department faculty, the strong leadership within the Department, and the success of the Center in meeting faculty and student needs.

### **Areas for Improvement**

The external reviewers cited the low enrollment in MSCSOR as an area that needs to be addressed. In addition, the reviewers cited advertisement of class offerings to other departments, graduate student support, and faculty research coordination as areas needing attention.

### **Strategic Plans**

The external reviewers agreed that the establishment of an “Institute for Applied Statistics and Operations Research” is probably unnecessary. Furthermore, the reviewers feel that an expansion of the Center can accomplish this objective without establishing a new entity.

### **Recommendations**

- A. The reviewers believe that the MSAS degree is healthy and the Department should continue participation in that program. They do not believe, however, that it is productive for the Department to continue its collaboration with the computer science department. The reviewers recommend collaborating with supply chain management and/or management information systems in establishing an operations management program within the College.
- B. The reviewers recommend increasing stipend levels for Master’s level I-III programs, and moving computer science and operations research into Master’s Level III from Master’s Level I.

- C. The reviewers believe that additional resources need to be invested in providing more technologically advanced classrooms.
- D. The review team strongly believes that a formal committee of statisticians from all departments at the University is needed. This committee would work toward establishing truly interdisciplinary collaborations and a graduate program in statistics.
- E. The review team recommends that notices of course offerings be well advertised to all potentially interested students in various departments and colleges.
- F. Student recruitment for the MSAS and MSCSOR programs is negatively impacted by the confusing structure of the Web sites for these programs. The review committee recommends that the Graduate College assist the Department to improve Web sites for these programs.
- G. The review team recommends that the College make available the resources for recruiting trips to four-year colleges around the Midwest.
- H. The review team recommends that faculty be encouraged to attend workshops on writing successful grant proposals.
- I. The review team believes that the “Data Mining” course be offered on a regular basis, and that the statistical consulting course be required for completion of the MSAS program.
- J. The review team strongly believes that the Statistical Consulting Center should expand its role to include clients external to the University on a fee-for-service basis. Further, they believe the College should take the lead in this, under its program of scholarship of engagement.
- K. The review team believes that the third instructor position needs to be designated as a hard line position by the College.

**PROGRAM REVIEW COMMITTEE  
FINDINGS AND RECOMMENDATIONS**

The PRC congratulates the Department on its preparation of the self-study materials and for the care and consideration given to all facets of the program review process.

**1. Overall Program Quality**

*Findings.* The Department has successfully established its centrality to the College of Business Administration. The Department reports a solid record of research, teaching, and service, and a continuing pursuit of external funding. The external

reviewers recognized the high quality of training provided in applied statistics and operations research, and singles the Department out for its high level of department collegiality.

*Recommendation.* The Committee concurs with these judgments and congratulates the faculty on the accomplishments to date, and especially their diligence in establishing their mission and setting goals for the future. It encourages them to keep up and improve on their good work, and to attend to the findings and recommendations below, so that the program will be even stronger five to seven years from now.

## **2. Research Productivity and External Funding**

*Findings.* The external reviewers did not comment directly on research productivity within the Department, but did comment on the need for greater research coordination among faculty. The Department reports an average of 1.1 publications per faculty per year. This seems to be a reasonable level of performance, but the level of productivity is uneven across the faculty members. External funding is an important source of external review and a quality indicator for the Department, and it provides additional resources to support scholarly efforts. To date, efforts toward external funding have been unsuccessful. The Department would benefit from a specific plan to increase research and funding success of the faculty. Such a plan could include a variety of strategies, including such things as the following: expressing research publication goals in terms of individual faculty rather than across faculty; faculty participation in workshops and meetings that will increase their chances of successfully competing for funds; and the Department Chair working with the Dean of the College of Business Administration on the possibility of course release for faculty most likely to secure external funding.

*Recommendation.* The Department should develop a plan designed to secure a higher level of external funding and increase the research productivity of the faculty. The plan should be submitted to the Dean of the College of Business Administration and to the Graduate Dean by the end of the 2006-07 academic year, for their review and approval.

## **3. Engagement Opportunities**

*Findings.* The external reviewers strongly urged the expansion of the Statistical Consulting Center to include clients external to the University on a fee-for-service basis. The widespread use of statistical packages has reduced the demand for statistical consulting by about one third. There seems to be an opportunity here for the Center to be transformed into a vehicle for engagement with the external community. The PRC agrees with this finding, but also sees that there are barriers to engagement, such as the amount of the “indirect costs” that are charged to external clients, that must be addressed for the Center to engage successfully with external clients.

*Recommendations.*

A. The Department should solicit the involvement of the Graduate Dean, the Dean of the College of Business Administration, the Dean of the College of Arts and Sciences, the Department of Mathematics and Statistics, and other relevant stakeholders to put together a plan for the future of the Statistical Consulting Center. This plan should reconsider the mission of the Center, and consider possibilities for engagement opportunities for students and faculty.

B. The Center needs to establish mutually beneficial relationships between the Center and local organizations. The Center should work with the deans to address the need for help in developing relations with the external community. Other centers on campus and off (e.g., the Center for Regional Development) could be used as a model for external functions of the Statistical Consulting Center. A report on developing external partners should be submitted to the Provost by the end of the 2006-07 academic year, for his review and approval,

#### **4. MSCSOR**

*Findings.* The external reviewers recommend against continuing to offer a joint program with the Department of Computer Sciences. Instead they recommend for the creation of an operations management program within the College of Business Administration. We are not convinced that such measures need to take place at this time, but it is clear that the “joint” student admission process remains an unresolved problem.

*Recommendation.* The Department must take positive steps to reach an agreement with the Department of Computer Science on the admission requirements for the MSCSOR program. The two departments must work collaboratively to enhance student recruitment, so that enrollment reaches a level of 10 to 12 students per year. The Department should meet with the Graduate Dean to develop a common plan for the admission, curriculum, and mission of the MSCSOR program. The plan should be in place by the end of the 2006-07 academic year.

#### **5. Curricular Changes to be Informed by Assessment**

*Findings.* Both graduate programs have established assessment practices. Furthermore, the Department participates in the college-level efforts to assess courses that are part of the BSBA and MBA programs. Significantly, the Department has used the results of assessment to make substantive changes in the curriculum.

*Recommendation.* Assessment of student learning is an ongoing process, vital to teaching and learning. The Department should build on its excellent progress in this area to date, and continue to develop and refine its assessment practices. Results of these efforts should be described in annual reports to the Student Achievement Assessment Committee.

## **6. Graduate Student Stipend Levels**

*Findings.* Stipend levels are not high enough to allow the University to attract the highly qualified students it seeks for the graduate programs. This is a recurring theme across departments and programs. The normal process of annual increases will not provide adequate resources to provide a system-wide solution. Further complicating the problem is the fact that programs and disciplines differ greatly in their ability to secure grant-funded assistantships.

*Recommendation.* As a university community, it will be essential to address the competitiveness of stipend levels. However, the solution cannot be solely to rely on internal funding of graduate stipends. Neither can individual departments take on the whole burden. Therefore, any efforts to increase stipend levels must involve a collaboration between the faculty, the departments, the colleges, and the Graduate College.

*The Department of Applied Statistics and Operations Research should report annually to the Dean of the College of Business Administration, with a copy to the Provost, on the implementation of these recommendations.*