Final Report  
Academic Program Review  
Department of Applied Statistics and Operations Research

Review Process

The Department of Applied Statistics and Operations Research prepared a self-study document following the program review guidelines. An external review team, composed of two faculty from other institutions, visited the campus, reviewed the self-study and interviewed unit personnel, students, and University administrators. The Program Review Committee (PRC) reviewed the self-study and external report and discussed both with the Dean of the College of Business Administration. This document reflects the PRC’s findings and recommendations.

Self-Study

Overview and Mission

The Department of Applied Statistics and Operations Research (ASOR) was established in 1978. Together with the Department of Mathematics and Statistics, ASOR offers a master’s degree in applied statistics (MSAS). ASOR also plays an important role in the master’s program in Computer Science with a concentration in Operations Research (MSCS/OR) by offering four of six required courses. ASOR also contributes to the B.S. in Business Administration and the M.B.A. program by offering courses in statistics and management science/operations research. The mission of ASOR is to promote the creation and growth of knowledge, interest, and applications in Statistics and Operations Research, to nurture the personal and professional development of all who participate in its academic programs and scholarly endeavors, and to assist those who require help pertaining to the disciplines of Statistics and Operations Research.

Budget, Facilities and Support Staff

The operating budget appears adequate for departmental needs. However, the self-study emphasizes that faculty salaries are generally below those of other public accredited institutions, and this difference is most striking for assistant professors. Current facilities have been adequate to support the instructional and research programs of the Department. The support staff (one full-time secretary) has been adequate over the past years and no additional staff are needed for the department’s current operations. However, the department is planning the creation of an Institute for Applied Optimization and Statistical Analysis, and may request an additional staff person(s) to help at first with the anticipated increase in workload. However, once the Institute begins to generate income, it is expected that the additional staff will be paid through money generated by the Institute.
**Faculty/Students**

At the time the self-study was written, the department had ten FTE; five tenure-track and five instructors. Since 1993 the department’s maximum FTE was 12. In addition to the faculty, numerous graduate assistants are involved in teaching classes. Since 1992, the faculty as a whole has averaged about 5.5 published articles per year. From 1992-1997 the faculty as a group was awarded three externally funded grants. Tenure/tenure track faculty typically teach nine hours per semester (instructors 12) and the workload seems equitably distributed. Reassigned time is provided for faculty with administrative duties. Faculty evaluation is based on a formula of 50% teaching, 35% research and 15% service.

The number of graduate students has ranged from a recent high of 55 in the spring of 1996 to a current (Fall '98) low of 35. The current student makeup is about 1/3 MSAS-ASOR, 1/3 MSAS-Math and Stat and 1/3 MSCS/OR. Gender makeup is 66% female; 71% of the students are international. GPA and GRE scores of incoming graduate students are good. Recently, there have been about 15 MSAS graduates per year with more than half from ASOR (compared to Math and Stat), and about five MSCS/OR graduates per year.

**Teaching**

The ASOR faculty has been averaging about 280 SCH/FTE/semester since 1993. In addition to supporting two graduate programs, ASOR teaches a number of undergraduate and graduate service courses for the College of Business Administration. It is also responsible for an introductory undergraduate statistics course for students outside the College of Business Administration. ASOR also plays a major role in the administration of the Statistical Consulting Center. Since 1977, the Department has provided a half-time release to a Ph.D. faculty member to serve as director, and since 1988, has also provided a half-time release for one of its instructors to serve as assistant director. Also, many students have served as consultants assisting members of the campus community.

**Quality of Curriculum/Assessment**

The self-study states that recent curricular goals have been achieved. Student satisfaction with MSAS and MSCS/OR programs was assessed by a survey. Of the 29 graduates that responded, close to 90% described the program as good or excellent. Weaknesses noted, among others, were:

1. Few group projects
2. Lack of statistical packages courses (e.g. SAS)
3. Not enough real life projects or internships

From 1992-1998, about 75% of students who enrolled in both programs successfully completed the degree. It is apparent from the self-study that the vast majority of students have gone on to gain relevant employment or have enrolled in graduate school (presumably Ph.D. programs). It is also apparent from the self-
study that there are abundant employment opportunities for people with degrees in applied statistics and operations research.

For the MSAS program, four “learning outcomes” have been identified for assessment of student learning. Assessment is generally based on a Master’s written comprehensive exam, class projects and an alumni survey. For the MSCS/OR program, four other “learning outcomes” have been developed that are assessed primarily through class projects, research projects, homework exercises, and oral presentations.

**Program Uniqueness**

The self-study offers numerous arguments highlighting ASOR’s unique contribution to education at BGSU, including: the ASOR faculty supply the critical applied emphasis in the MSAS program; the MSAS program is the only one of its kind in northwest Ohio; and the requirement of a cognate area and a class in sampling methodology is unique. The MSCS/OR program is also unique with respect to its mixture of computer science and operations research.

**Goals and Strategies**

The ASOR faculty has put together an ambitious plan for growth and improvement for the next five years. The plan includes:

1. Achieving the department’s immediate goals (b-f) are predicated on hiring three new replacement faculty, yielding five faculty in applied statistics and three in operations research. Some of the more ambitious goals (e.g. b, below) would require two additional faculty lines, one in each subdiscipline.
2. Create an Institute for Applied Optimization and Statistical Analysis. Some goals of the institute are to establish mutually beneficial relationships between ASOR and area companies, to enhance the degree programs by providing faculty and students with exposure to practical problems, to create an environment conducive to applied research, and to provide an avenue for attracting grants for faculty research.
3. Gain more control over the MSCS/OR program, eventually converting it into an MS in OR/CS.
4. Modify and enhance the MSAS program, particularly with respect to new courses and improved curriculum as well as the development of concentration areas.
5. Increase the number of proposals submitted by the department for external support of research.
6. Seek alternative stipend support for graduate students (e.g. b,e).

**Epilogue**

The self-study concludes with the following statement: “The interests of the ASOR faculty lie more in the applications of statistics and operations research, and working with others through inter-disciplinary activities such as joint research
and support of the Statistical Consulting Center... We firmly believe that keeping the Department of Applied Statistics and Operations Research as a department in the College of Business Administration will enable us to pursue our goals... Therefore, the faculty...are opposed to merging the Department of Applied Statistics and Operations Research with the Department of Mathematics and Statistics.”

**External Review Findings**

In general, the external review team viewed the current ASOR faculty as doing solid work despite the considerable handicap of only five current tenure/tenure track FTE compared to a historical baseline of eight. They believe it is imperative that a plan be constructed and acted on to restore ASOR to eight faculty over the next three years. Otherwise, they believe, we will expect to see declining research productivity and lessening student interest in the department’s offerings. In short, the external reviewers state the problem with the department is one of personnel resources. Finally, the external review team not only believes the department should stay in the College of Business Administration, but should also play a more visible/dynamic role in the two collaborative Master’s degree programs.

**Classroom Evaluation/Curriculum**

The external review team commented that the availability of ASOR course offerings seems adequate, but clearly the implied message was that more needs to be done (see their recommendations below). They mention the lack of a “developed academic network” for its students - the need to build close ties with other departments at BGSU, connections with neighboring universities (e.g. Toledo), and organizational contacts in Ohio and Michigan. They also point out that the lack of an undergraduate feeder program can negatively impact program development. Appendix 2 of their report highlights some curricular suggestions.

**Faculty Evaluation**

The external review team was impressed with the “pedigree” of the ASOR faculty and felt the research record of the faculty was quite good, but did not offer any criteria by which “quite good” could be interpreted. They also felt that an important step in program development is a strengthening of the relationship between Applied Statistics and the Department of Mathematics and Statistics, and oddly enough, a tightening up of the relationship between the Applied Statistics faculty and the Operations Research program. They note the faculty needs to expand the applied (industrial) experience of the faculty.

**Applied Statistics: Problems**

The reviewers argue that whatever problems Applied Statistics may have (primarily faculty shortage), fusing the department with Mathematics and
Statistics or creating a new Department of Statistics is not the solution. See *Faculty Evaluation* (above) for other issues.

**Operations Research: Problems**

The reviewers believe that many if not all of the problems in Operations Research (“...lack of a broad set of academic and scholarly activities...”) can be traced in large part to the lack of direct control over their own professional activities. They strongly recommend that as a program enhancement measure the MS in Computer Science/Operations Research be moved to ASOR (its current administrative home seems to be in Computer Science) without interfering with the strong and distinctive computing component of the program. They also emphasize that computing can come into such a curriculum in many different forms: classical computer science, areas of information systems, computational science and information technology. However, they recommend such a move only when the department is back to full strength in operations research.

**External Review Report Recommendations**

1. The external review recommends three new faculty lines over the next two to three years (applied statistics, operations research, applied statistics). However, awarding these lines should be based on performance, including the establishment of the Institute for Applied Optimization and Statistical Analysis, identification of a departmental focus and the development of an instructional plan in collaboration with the Department of Mathematics and Statistics.

2. The outside reviewers continually emphasize the urgent need for the Institute for Applied Optimization and Statistical Analysis, which would clearly serve as a rallying point around which the department could create an identity and facilitate contact with local industry and applied experiences for students.

3. The ASOR faculty need to work more closely with Mathematics and Statistics to provide the best possible educational offerings to students. The Operations Management course needs to emphasize analytical methods.

4. The consulting course needs to be taught annually, taking advantage of the proposed institute.

5. The department should provide the appropriate administrative office with an annual report summarizing success in student job placement.

6. If and when the Operations Research program is placed under control of ASOR (see *Operations Research: Problems*), the time will be right for Operations Research to engage in extensive cooperative efforts with other units in the College of Business Administration including applied statistics, management information systems, finance management and marketing. This cooperative effort should impact all aspects of scholarly activity including academic program development, research and corporate outreach.
7. The outside reviewers further suggest that one additional faculty in Operations Research may not be enough to create a functional unit, and more lines will be needed to substantially upgrade the department with respect to a diversified curriculum. Currently the course offerings in Operations Research are “skimpy at best” and courses in decision analysis and mathematical modeling languages are needed now.

8. Finally, the outside reviewers close by suggesting that the loss of Applied Statistics and Operations Research will negatively impact the quality of the MBA program.

Program Review Committee Findings

Despite some strengths noted below, the PRC has serious concerns about investment in the growth of this department.

Strengths Identified by the Program Review Committee

The PRC recognizes four important contributions of the ASOR faculty to the academic environment of BGSU: 1) administering the Statistical Consulting Center represents a substantial service contribution that benefits the entire university; 2) a number of courses taught by the faculty play an important role in both the undergraduate and graduate curriculum of the College of Business Administration; 3) the ASOR faculty play a critical role in both their joint graduate programs; and 4) the program has a good record of placing its graduates in organizations and Ph.D. programs.

Concerns Identified by the Program Review Committee

The strengths of ASOR are primarily attributable to individuals. Strengths at the programmatic level are more difficult to identify. Put another way, the strengths identified do not appear to depend on or to be augmented by the department structure. For instance,

- the department offers courses that are significant to the BSBA, but the courses in and of themselves are not a sufficient rationale for a department;
- the graduate programs are significant, but they are not ASOR’s programs alone; furthermore, the case has not been made that stronger programs in MSAS and MSCS/OR would contribute to the mission of the College;
- the mission statement of the department is heavily service oriented – can that service be provided outside a department structure? Alternatively, can the department make a stronger case for its role in functions that go beyond service?

The PRC was also concerned about the structure of the department’s plan for improvement. The plan asks for resources first and promises return on that investment. The PRC’s recommendations typically run the other way: if a department delivers on specific program improvements, then we recommend additional support. How can the department demonstrate that it is worth the investment it asks for? The external reviewers made a few suggestions for
innovations that would not require resources (building contacts with business as a prelude to the establishment of the Institute for Applied Optimization and Statistical Analysis, identification of a departmental focus, and the development of an instructional plan in collaboration with the Department of Mathematics and Statistics). The PRC also notes that curricular innovations and the development of a research plan in consultation with the Vice Provost for Research are possible without additional resources.

Although the outside reviewers offered reasons for the continuation and growth of ASOR, their recommendations were based on an idealized goal for the discipline rather than an assessment of how this particular department contributes to the goals of the University. At a university of limited resources, investment decisions must be based on the centrality or importance of programs and on prospects for success. Neither the self-study nor the external reviewers’ report has convinced the PRC of the centrality of ASOR to the College of Business Administration or of the likely return on additional investment in this department.

ASOR presents a difficult case on which to make recommendations. On the one hand, the statistics and operations research courses offered by the department are important to the college, the shared graduate programs are a noteworthy contribution, the programs have had excellent job placements for their students, and the Statistical Consulting Center is a very valuable university service. On the other hand, the case has not been made that additional investment in ASOR will produce a valuable return on the investment, especially in light of alternative investments the college might make.

**Program Review Committee Recommendations**

The University’s aspiration to become the premier learning community in Ohio and one of the best in the nation calls upon each academic department to identify an area in which it can achieve distinction. Although the ASOR department may be able to contribute to the University’s vision through its focus on the application of statistics and operations research to a wide variety of practical problems, the PRC concludes that the potential of that focus has not been realized. Clarification of the mission of the department, its centrality to the mission of the College, and the alignment of structure with mission are thus the goals of the following recommendations. The PRC believes that levels of investment in ASOR should parallel centrality.

1) The Dean, with the advice of the College Council of Chairs, should work closely with the Department in deciding on one of the three following options, by May, 2000:
   a) The ASOR mission is one of service to the College, but can be accomplished without a departmental structure devoted to that function. The Dean and departmental faculty members should develop a plan to reassign the Applied Statistics faculty and the Operations Research faculty to other academic units. For instance, the Department of Management with its production and purchasing emphasis would be a candidate to receive the OR faculty. Options for restructuring need not be limited to the College of
Business Administration. Please see, in particular, the final report for Mathematics and Statistics for a list of pros and cons of placing Applied Statistics faculty in the Mathematics and Statistics department. The Dean should take into account the individual faculty’s expertise and preference in placing them in appropriate units.

b) The ASOR mission is valuable to the College and can best be fulfilled within the current structure. However, the program is not central to the College and should receive no new resources for growth. In this scenario, the challenge is to develop a plan for excellence within the context of current levels of staffing and support. Such a plan would be aided by the implementation of differential teaching loads, such that reduced teaching is contingent on research productivity. A revised seven-year plan, including re-evaluation of the department mission, should be developed, by December, 2000, in light of the resources available under this option. The PRC recommends against this option.

c) The ASOR mission is central to the College and warrants additional faculty resources. The PRC recommends that the department make visible progress, by December, 2000, on a number of issues as a prerequisite to additional investment.

i) Write a mission statement that identifies the centrality of the department to the College.

ii) Attend to curricular issues raised by the external reviewers.

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

iv) Develop a departmental research plan to be reviewed and approved by the Dean of the College of Business Administration and the Vice Provost for Research.

v) Establish contacts and collaborations with area businesses that would provide the foundation for the proposed Institute.

vi) Make tangible progress in conversations with Computer Science that would bring the MSCS/OR degree within the ASOR department.

vii) Make tangible progress developing collaborations with Mathematics and Statistics regarding the MSAS degree and the cooperative development of the Statistical Consulting Center.

2) If either option 2) b) or 2) c) has been chosen, then the Department should complete a viability report to the Dean of the College of Business Administration to evaluate progress on the above recommendations. The report should be completed by the Spring semester, 2002.

a) If the Dean is not satisfied with the progress made, he should discontinue the Department, as described in recommendation 2) a).

b) If the Dean decides that the Department has made sufficient progress, then the College should provide additional support appropriate to the level of progress.

3) The faculty search for an operations research specialist should be suspended until the role and mission of Operations Research has been clarified.

4) The Statistical Consulting Center is a paradigmatic example of an under-funded yet important BGSU academic center. Considering the available resources, the Center’s director has done a remarkable job. In light of this service and others – grant support, services to graduate programs, consultation
to outside agencies, teaching – the PRC does not recommend the suspension of the search currently underway for Applied Statistics faculty. Indeed, given the importance of the Statistical Consulting Center to the University community at large, we strongly recommend to the provost that he/she investigate how more money can be directed to the Statistical Consulting Center. For example, a redistribution of ORA (overhead return) funds might be worth considering.

5) The Statistical Consulting Center makes a clear and substantial contribution to the university community. The PRC encourages the Dean of the College of Business Administration, the applied statistics faculty, and the operations research faculty to take advantage of the Consulting Center to expand outreach opportunities to local business and government, to enhance student “hands on” education and to pursue outside contractual arrangements to help support the Center. If progress is made in these areas, the Center could become a target for university support. For example, if after three years measurable progress is made in these areas, the Center staff could bring the proposal for the Institute for Applied Optimization and Statistical Analysis forward for review by the Graduate Council.

6) The two, current joint graduate programs should continue and the current ASOR faculty should continue to teach courses that contribute to these programs. The Dean of the College of Business Administration, the Dean of the College of Arts and Sciences, and the Chairs of the Departments of Mathematics and Statistics and Computer Science must work together to insure the vitality of these graduate programs.

7) Assessment of student learning outcomes is an ongoing need in the two shared masters’ programs. The learning objectives for the program should be completely reviewed during the academic year 1999-2000. Mechanisms for assessing student achievement of those objectives should be implemented in 2000-01, if not before. The initial implementation can be at the scale of a pilot project, or for a subset of the learning objectives of the program. Thereafter, progress on assessment should be reported on an annual basis, according to the procedures established by the Student Achievement Assessment Committee.

The Chair of ASOR should report annually to the Dean of the College of Business Administration, with a copy to the Provost, on the implementation of these recommendations.