Operations Research Analysts

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Significant Points

- Employers generally prefer applicants with at least a master's degree in operations research or a closely related field, such as computer science, engineering, business, mathematics, information systems, or management science.
- Employment growth is projected to be slower than average, reflecting slow growth in the number of jobs with the title "operations research analyst."
- Individuals with a master's or Ph.D. degree in management science or operations research should have good job opportunities as operations research analysts or in closely related occupations, such as systems analysts, computer scientists, or management analysts.

Nature of the Work

Operations research and *management science* are terms that are used interchangeably to describe the discipline of applying advanced analytical techniques to help make better decisions and to solve problems. The procedures of operations research have given effective assistance during wartime missions, such as deploying radar, searching for enemy submarines, and getting supplies where they were most needed. New analytical methods have been developed and numerous peacetime applications have emerged, leading to the use of operations research in many industries and occupations.

The prevalence of operations research in the Nation's economy reflects the growing complexity of managing large organizations that require the effective use of money, materials, equipment, and people. Operations research analysts help determine better ways to coordinate these elements by applying analytical methods from mathematics, science, and engineering. They solve problems in different ways and propose alternative solutions to management, which then chooses the course of action that best meets the organization's goals. In general, operations research analysts may be concerned with diverse issues such as top-level strategy, planning, forecasting, resource allocation, performance measurement, scheduling, the design of production facilities and systems, supply chain management, pricing, transportation and distribution, and the analysis of large databases.

The duties of the operations research analyst vary according to the structure and management philosophy of the employer or client. Some firms centralize operations research in one department; others use operations research in each division. Operations research analysts also may work closely with senior managers to identify and solve a variety of problems. Some organizations contract operations research services with a consulting firm. Economists, systems analysts, mathematicians, industrial engineers, and others may apply operations research techniques to address problems in their respective fields. (These occupations are discussed elsewhere in the *Handbook*.)

Regardless of the type or structure of the client organization, operations research in its classical role entails a similar set of procedures in carrying out analysis to support management's quest to improve performance. Managers begin the process by describing the symptoms of a problem to the analyst, who then formally defines the problem. For example, an operations research analyst for an auto manufacturer may be asked to determine the best inventory level for each of the parts needed on a production line and to ascertain the optimal number of windshields to be kept in inventory. Too many windshields would be wasteful and expensive, while too few could result in an unintended halt in production.

Operations research analysts study such problems, breaking them into their components. Analysts then gather information about each of the components from a variety of sources. To determine the most efficient amount of inventory to be kept on hand, for example, operations research analysts might talk with engineers about production levels, discuss purchasing arrangements with buyers, and examine storage-cost data provided by the accounting department.

With the relevant information in hand, the analyst is ready to select the most appropriate analytical technique. Analysts can use any of several techniques, including simulation, linear and nonlinear programming, dynamic programming, queuing and other stochastic-process models, Markov decision processes, econometric methods, data envelopment analysis, neural networks, expert systems, decision analysis, and the analytic hierarchy process. Nearly all of these techniques, however, involve the construction of a mathematical model that attempts to describe the system being studied. The use of models enables the analyst to assign values to the different components and clarify the relationships among them. The values can be altered to examine what may happen to the system under different circumstances.

In most cases, the computer program developed to solve the model must be modified and run repeatedly to obtain different solutions. A model for airline flight scheduling, for example, might include variables for the cities to be connected, the amount of fuel required to fly the routes, projected levels of passenger demand, varying ticket and fuel prices, pilot scheduling, and maintenance costs. By locating the right combination of values for the variable, the analyst is able to produce the best flight schedule consistent with particular assumptions.

Upon concluding the analysis, the operations research analyst presents management with recommendations based on the results. Additional computer runs to consider different assumptions may be needed before the analyst presents the final recommendation. Once management reaches a decision, the

Operations research analysts study organizational efficiency and suggest ways to improve an organization's performance.

analyst usually works with others in the organization to ensure the plan's successful implementation.

Working Conditions
Operations research analysts generally work regular hours in an office environment. Because they work on projects that are of immediate interest to top management, operations research analysts often are under pressure to meet deadlines and work more than a 40-hour week.

Employment
Operations research analysts held about 61,700 jobs in 2002. Major employers include telecommunication companies, aerospace manufacturers, computer systems design firms, financial institutions, insurance carriers, engineering and management services firms, and Federal and State governments. More than 4 out of 5 operations research analysts in the Federal Government work for the Department of Defense, and many in private industry work directly or indirectly on national defense. About 1 out of 5 analysts works in architectural, engineering, or related services; computer systems design and related services; management, scientific, and technical consulting services; and scientific research and development firms that offer consulting services in the field of operations research.

Training, Other Qualifications, and Advancement
Employers generally prefer applicants with at least a master's degree in operations research or a closely related field, such as computer science, engineering, business, mathematics, information systems, or management science, coupled with a bachelor's degree in computer science or a quantitative discipline, such as economics, mathematics, or statistics. Dual graduate degrees in operations research and computer science are especially attractive to employers. Operations research analysts also must be able to think logically and work well with people, and employers prefer workers with good oral and written communication skills.

In addition to supporting formal education in one manner or another, employers often sponsor training for experienced workers, helping them keep up with new developments in operations research techniques and computer science. Some analysts attend advanced university classes on these subjects at their employer's expense.

Because computers are the most important tools for performing in-depth analysis, training and experience in programming are required. Operations research analysts typically need to be proficient in database collection and management, programming, and the development and use of sophisticated software packages.

Beginning analysts usually perform routine work under the supervision of more experienced analysts. As the novices gain knowledge and experience, they are assigned more complex tasks and given greater autonomy to design models and solve problems. Operations research analysts advance by assuming positions as technical specialists or supervisors. The skills acquired by operations research analysts are useful for a variety of higher level management jobs, so experienced analysts may leave the field to assume nontechnical managerial or administrative positions. Operations research analysts with significant experience may become consultants, and some may even open their own consulting practice.

Job Outlook
Employment of operations research analysts is expected to grow more slowly than the average for all occupations through 2012, reflecting slow growth in the number of jobs with the title "operations research analyst." Job opportunities in operations research should be good, however, because organizations throughout the economy will strive to improve their productivity, effectiveness, and competitiveness and because of the extensive availability of data, computers, and software. Many jobs in operations research have other titles, such as "operations analyst," "management analyst," "systems analyst," and "policy analyst." Individuals who hold a master's or Ph.D. degree in operations research, management science, or a closely related field should find good job opportunities because the number of openings generated by employment growth and the need to replace those leaving the occupation are expected to exceed the number of persons graduating with those credentials.

Organizations face pressure today from growing domestic and international competition and must work to make their operations as effective as possible. As a result, businesses will increasingly rely on operations research analysts to optimize profits by improving productivity and reducing costs. As new technology is introduced into the marketplace, operations research analysts will be needed to determine how to utilize the technology in the best way.

Opportunities for operations research analysts exist in almost every industry because of the diversity of applications for their work. However, opportunities should be especially good in highly competitive industries, such as manufacturing, transportation, telecommunications, and finance. As businesses and government agencies continue to contract out jobs to cut costs, many operations research analysts also will find opportunities as consultants, either working for a consulting firm or setting up their own practice. Opportunities in the military will exist as well, but will depend on the size of future military budgets. As the military develops new weapons systems and strategies, military leaders will rely on operations research analysts to test and evaluate their accuracy and effectiveness. (See the *Handbook* statement on job opportunities in the Armed Forces.)

Earnings
Median annual earnings of operations research analysts were $56,920 in 2002. The middle 50 percent earned between $43,220 and $74,460. The lowest 10 percent had earnings of less than $34,140, while the highest 10 percent earned more than $92,430.

The average annual salary for operations research analysts in the Federal Government in nonsupervisory, supervisory, and managerial positions was $83,740 in 2003.

Related Occupations
Operations research analysts apply advanced analytical methods to large, complicated problems. Workers in other occupations that stress advanced analysis include computer systems analysts, database administrators, and computer scientists; computer programmers; engineers; mathematicians; statisticians; economists; and market and survey researchers. Because its goal is improved organizational effectiveness, operations research also is closely allied to managerial occupations, such as

computer and information systems managers, and management analysts.

Sources of Additional Information

Information on career opportunities for operations research analysts is available from

➤ Institute for Operations Research and Management Science, 901 Elkridge Landing Rd., Suite 400, Linthicum, MD 21090. Internet: **http://www.informs.org**

For information on operations research careers in the Armed Forces and the U.S. Department of Defense, contact

➤ Military Operations Research Society, 1703 N. Beauregard St., Suite 450, Alexandria, VA 22311. Internet: **http://www.mors.org**

Information on obtaining an operations research analyst position with the Federal Government is available from the Office of Personnel Management (OPM) through a telephone-based system. Consult your telephone directory under U.S. Government for a local number or call (703) 724-1850; Federal Relay Service: (800) 877-8339. The first number is not tollfree, and charges may result. Information also is available from the OPM Internet site: **http://www.usajobs.opm.gov**.