Operations Research Analysts

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Significant Points

- While a bachelor's degree is the minimum requirement, employers generally prefer applicants with at least a master's degree in operations research or a closely related field.

- Computer programming skills and keeping up to date with technological advances and improvements in analytical methods are essential.

- Employment growth is projected to be as fast as the average for all occupations.

- Individuals with a master's or Ph.D. degree in operations research or a closely related subject should find opportunities in a number of occupations that use their computer, mathematical, and problem-solving skills.

Nature of the Work

"Operations research" and "management science" are terms that are used interchangeably to describe the discipline of using advanced analytical techniques to make better decisions and to solve problems. The procedures of operations research were first formalized by the military. They have been used in wartime to effectively deploy radar, search for enemy submarines, and get supplies to where they are most needed. In peacetime and in private enterprises, operations research is used in planning business ventures and analyzing options by using statistical analysis, data and computer modeling, linear programming, and other mathematical techniques.

Large organizations are very complex. They must effectively manage money, materials, equipment, and people. Operations research analysts find better ways to coordinate these elements by applying analytical methods from mathematics, science, and engineering. Analysts often find many possible solutions for meeting the goals of a project. These potential solutions are presented to managers, who choose the course of action that they think best.

Operations research analysts are often involved in top-level strategizing, planning, and forecasting. They help to allocate resources, measure performance, schedule, design production facilities and systems, manage the supply chain, set prices, coordinate transportation and distribution, or analyze large databases.

The duties of the operations research analyst vary according to the structure and management of the organization they are assisting. 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. Analysts often have one area of specialization, such as working in the transportation or the financial services industry.

Operations research analysts start a project by listening to managers describe a problem. Then, analysts ask questions and formally define 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 stock. Too many windshields would be wasteful and expensive, whereas too few could halt production.

Analysts would study the problem, breaking it into its components. Then they would gather information from a variety of sources. To determine the optimal inventory, 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.

Relevant information in hand, the analysts determine the most appropriate analytical technique. Techniques used may include a Monte Carlo 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 involve the construction of a mathematical model that attempts to describe the system being studied. So, the problem of the windshields, for example, would be described as a set of equations that try to model real-world conditions.

The use of models enables the analyst to explicitly describe the different components and clarify the relationships among them. The descriptions can be altered to examine what may happen to the system under different circumstances. In most cases, a computer program is developed to numerically evaluate the model.

Usually the model chosen is modified and run repeatedly to obtain different solutions. A model for airline flight scheduling, for example, might stipulate such things as connecting cities, 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 assessing different possible schedules, the analyst is able to determine the best flight schedule consistent with particular assumptions.

Based on the results of the analysis, the operations research analyst presents recommendations to managers. The analyst may need to modify and rerun the computer program to consider different assumptions before presenting the final recommendation. Once managers reach a decision, the analyst usu-

Operations research analysts need strong computer, mathematical, and problem-solving skills.

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

Work environment. Operations research analysts generally work regular hours in an office environment. However, because they work on projects that are of immediate interest to top managers, operations research analysts often are under pressure to meet deadlines and may work more than 40 hours a week.

Training, Other Qualifications, and Advancement

A college degree in operations research generally is required. Computer programming skills are essential.

Education and training. 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. There are more than 130 programs in operations research and related studies in colleges and universities across the United States.

Continuing education is important for operations research analysts. Keeping up to date with technological advances and improvements in analytical methods is vital for maintaining their problem-solving skills.

Other qualifications. Computers are the most important tools used by operations research analysts, so analysts must have training and experience in programming. Analysts typically also need to be proficient in database collection and management, and the development and use of sophisticated software packages.

Operations research analysts must be able to think logically, work well with people, and write and speak well.

Advancement. Beginning analysts usually perform routine work under the supervision of more experienced analysts. As novices gain knowledge and experience, they are assigned more complex tasks and are given greater autonomy to design models and solve problems.

Operations research analysts can advance by becoming technical specialists or supervisors on more complicated projects. Analysts also gain valuable insights into the industry where they work and may assume higher level managerial or administrative positions. Operations research analysts with significant experience or expertise may become consultants, and some open their own consulting practices.

Employment

Operations research analysts held about 58,000 jobs in 2006. Major employers include computer systems design firms; insurance carriers and other financial institutions; telecommunications companies; management, scientific, and technical consult-ing services firms; and Federal, State, and local governments. Most 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.

Job Outlook

Employment of operations research analysts is projected to grow as fast as the average for all occupations. Individuals with a master's or Ph.D. degree in operations research or a closely related subject should find job opportunities in a number of occupations that use their computer, mathematical, and problem-solving skills.

Employment change. Employment of operations research analysts is expected to grow 11 percent, as fast as the average for all occupations between 2006 and 2016. Demand for operations research analysis should continue to grow. Organizations increasingly will be faced with the pressure of growing domestic and international competition and must work to make their operations as effective as possible. As a result, businesses increasingly will 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 use the technology in the best way.

Additionally, technological advancements have extended the availability of data access and storage, making information more readily available. Advancements in computing capabilities and analytical software have made it cheaper and faster for analysts to solve problems. As problem solving becomes cheaper and faster with technological advances, more firms will have the ability to employ or consult with analysts.

Job prospects. Graduates with degrees in operations research or closely related fields should find opportunities in a number of occupations where their computer, mathematical, and problem-solving skills are needed—operations research analyst, systems analyst, computer scientist, or management analyst, for example. In addition to job growth, some openings will result from the need to replace analysts retiring or leaving the occupation permanently for other reasons. Analysts who keep up with the latest technological advancements and software will have the best opportunities.

Jobs for operations research analysts exist in almost every industry because of the diversity of applications for their work. As businesses and government agencies continue to contract out jobs to cut costs, opportunities for operations research analysts will be best in management, scientific, and technical consulting firms. Opportunities in the military exist as well, but will depend on the size of future military budgets. Military leaders rely on operations research analysts to test and evaluate the accuracy and effectiveness of new weapons systems and

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Operations research analysts..	15-2031	58,000	65,000	6,200	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

strategies. (See the *Handbook* statement on job opportunities in the Armed Forces.)

Earnings

Median annual earnings of operations research analysts were $64,650 in May 2006. The middle 50 percent earned between $48,820 and $85,760. The lowest 10 percent had earnings of less than $38,760, while the highest 10 percent earned more than $108,290. Median annual earnings of operations research analysts working in management, scientific, and technical consulting services were $69,870.

The average annual salary for operations research analysts in the Federal Government in nonsupervisory, supervisory, and managerial positions was $91,207 in 2007.

Employer-sponsored training is often another part of an analyst's compensation. Some analysts attend advanced university classes on these subjects at their employer's expense.

Related Occupations

Operations research analysts apply advanced analytical methods to large, complicated problems. Economists, computer systems analysts, mathematicians, and engineers also use advanced analysis and often apply the principles of operations research. Workers in other occupations that also stress advanced analysis include computer scientists and database administrators, computer programmers, statisticians, 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

For information on career opportunities and a list of degree programs for operations research analysts, contact:
➤ Institute for Operations Research and the Management Sciences, 7240 Parkway Dr., Suite 310, Hanover, MD 21076. Internet: **http://www.informs.org**

For information on operations research careers and degree programs in the Armed Forces, contact:
➤ Military Operations Research Society, 1703 N. Beauregard St., Suite 450, Alexandria, VA 22311.
Internet: **http://www.mors.org**

Information on obtaining positions as operations research analysts with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at:

http://www.bls.gov/opub/ooq/2004/summer/art01.pdf.