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Quality Engineering as a Discipline of Study

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Quality Engineering as a Discipline of Study

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Abstract

The current framework for quality scholarship in the United States ranges from the training and education of future quality engineers, managers, and professionals to focused and sustained research initiatives that, through academic institutions and other organizations, aim to improve the knowledge and application of quality across a variety of sectors. Numerous quality journals also provide a forum for professional dissemination of information.

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1. QUALITY ENGINEERING AS A DISCIPLINE OF STUDY

Quality is a dynamic discipline, rich with topics that lend themselves to focused academic study and practical applications. The current framework for quality scholarship in the United States ranges from the training and education of future quality engineers, managers, and professionals to focused and sustained research initiatives that, through academic institutions and other organizations, aim to improve the knowledge and application of quality across a variety of sectors. Whether they are gaining knowledge or adding to an existing repository of learning, quality professionals have access to many resources to improve their engagement with the field.

1.1. Academic Programs in Quality

At the beginning of their postsecondary education, aspiring quality engineers often pursue Bachelor of Science programs in engineering technology. The curriculum for quality engineering bachelor's programs typically incorporates laboratory-based assignments with classroom instruction and computer applications. In addition to the core engineering classes, students must complete supporting coursework in economics, calculus, physics, and chemistry. Master's degree programs in quality engineering often take the form of a concentration within an industrial Master of Science or Master of Engineering program. These master's programs require a substantial amount of project-based laboratory work, and often allow students to choose between completing a thesis or comprehensive exam for their capstone academic requirement. Many master's programs prepare students to take one of the quality certification exams offered by the American Society for Quality (ASQ). Additionally, some schools offer Ph.D. programs in quality management or quality engineering, usually as a specialization within an industrial engineering program.

Many colleges and universities nationwide offer concentrations in quality and quality management as part of engineering and business administration programs. Even at universities where a specialization in quality is not possible as part of a degree program, specific courses covering quality management, quality engineering, and related topics are often listed among overall degree requirements. Certain colleges offer certification in various aspects of the quality field, including quality engineering, quality management, quality auditing, reliability engineering, and software quality engineering. ISO and Lean Six Sigma certification courses are frequently included among these programs. Resources such as *Quality Progress*, the flagship publication of the American Society for Quality, track comprehensive listings of national and international colleges and universities that offer academic programs, concentrations, or certifications in quality. Foreign nations whose academic institutions offer some dimension of quality-focused training include Canada, Denmark, Korea, and Sweden.

While courses and concentrations on quality are readily available nationwide, and while many students majoring in engineering or management disciplines can incorporate a quality focus into their chosen area of study if desired, fewer colleges and universities offer specialized

degree programs in quality at the bachelor's or master's level. Some of these programs are listed below, to give a sense of the breadth available in the field.

- San Jose State University in San Jose, California offers a master's degree and certification in quality assurance.

- Eastern Michigan University near Ann Arbor, Michigan offers a master's degree as well as a graduate certificate in quality.

- Ferris State University in Grand Rapids, Michigan offers a bachelor's degree in quality engineering technology.

- The University of Minnesota in Minneapolis, Minnesota offers quality degree programs through its Carlson School of Management's Joseph M. Juran Center for Leadership in Quality.

- Rutgers University in New Brunswick, New Jersey offers a master's and doctorate degree in quality and reliability engineering, within the department of industrial and systems engineering and the department of statistics.

- The Deming Scholars Program at the Fordham University Graduate School of Business Administration in New York offers an 18-month MBA in management systems.

- Pennsylvania State University in University Park, Pennsylvania offers bachelor's and master's degrees in quality and manufacturing management.

- The National Graduate School of Quality Management, based in five states including California and Texas, offers a master's degree in quality systems management as well as extensive quality certification opportunities.

A specific degree in quality is not a prerequisite for incorporating quality topics into one's field of study or engineering career. Some students alternatively choose to pursue degrees in applied statistics, systems engineering and analysis, business administration, or industrial management en route to a career in quality engineering or quality management.

1.2. Quality Research Centers and Research Topics

Many universities offering postgraduate degrees with quality specializations or concentrations carry out some form of research in quality management, engineering, or processes. If nothing else, master's or doctoral students pursuing academic programs in quality use their capstone projects to add to the realm of quality-related knowledge, and many leading research universities in science, engineering, and management disciplines sustain quality research initiatives. However, in addition to such institutions there are also several specialized centers for quality across the country that focus on studying quality engineering, operations, and management as a distinct discipline of study. These centers frequently collaborate with their

associated universities and offer programs for advancing quality knowledge and publications in a variety of industrial and service fields. A few notable research centers and their quality-related initiatives are described in the following paragraphs.

The Joseph M. Juran Center for Research in Supply Chain, Operations, and Quality at the University of Minnesota's Carlson School of Management conducts research in and advances the theory and practices of quality leadership. Founded on the vision and principles of well-known quality professional Joseph M. Juran, the Juran Research Center promotes knowledge of past developments in the field of quality and also generates new research, ideas, and scholars and students of quality. To advance the theory and practice of quality leadership, it supports three critical efforts: 1) a fellowship program that supports quality-related doctoral research within and beyond the University of Minnesota, 2) a continuing program of research conducted and disseminated by scholars in partnership throughout the world, and 3) a repository body of knowledge of its past scholarly contributions. The Juran Research Center was established in 1998 under the leadership of Juran himself and through the assets of the Juran Foundation, and is currently home to Juran's professional quality memorabilia and papers. Many past Juran Fellows are now faculty at leading research universities.

The Center for Quality and Productivity Improvement (CQPI) in Madison, Wisconsin conducts research on methods of quality improvement and provides a forum for students and professionals to exchange ideas on topics related to quality. The center works collectively with the University of Wisconsin-Madison College of Engineering, Graduate School of Business, and Department of Statistics. Established in 1985 after the international quality revolution, CQPI's interdisciplinary research has led to the development of new techniques for improving the quality of products and processes. Besides conducting research on different public and private sectors, CQPI partners with diverse organizations, helping to apply quality knowledge to real-world operations and management philosophies.

The W. Edwards Deming Center for Quality, Productivity, and Competitiveness at the Columbia Business School in New York is a consortium of leading institutions that exchange research, best practices, and strategic planning to create operational excellence in major corporations worldwide. Founded in 1990 during Deming's last year of teaching at Columbia, the Deming Center sponsors applied research, education and professional development, and corporate partnerships in the area of quality management. The Deming Center aims to 1) train a new generation of managers by developing curriculum materials on operations management and strategy; 2) reach senior executives through forums, executive education, and publications; and 3) conduct applied research that will produce new knowledge related to the field of operations management.

Quality research also exists outside of academic institutions, notably through sector-specific research and application centers and through the American Society for Quality (ASQ). The ASQ is a global community of quality resources and experts that advances many professional development, knowledge, research, and certification activities relating to quality and quality management. The organization provides individual, site, enterprise, and education memberships and promotes recent quality research through several initiatives. Its Learning Institute offers a comprehensive list of courses and certifications, its Knowledge Center provides

access to quality tools and resources, and its events and conferences provide a forum to link different thinkers and professionals within the quality community. The ASQ annual World Conference on Quality and Improvement is the organization's premier event, but other ASQ conferences include the Lean and Six Sigma Conference and the National Quality Education Conference. The ASQ conducts research on many issues relating to quality and quality management, frequently partnering with companies and academic institutions to release studies and reports to enhance the knowledge and competency of quality professionals. Its Future of Quality Study, conducted every three years, identifies key forces most likely to shape the future of quality and assesses implications for organizations and quality professionals. Finally, the ASQ's annual surveys on manufacturing outlook and salaries for quality professionals provide practical resources for those assessing the state of the field.

Regardless of the research location or institution, current research on quality-related topics covers a wide range of applications and sectors. Theories, concepts, and methodologies of human factors engineering research applies knowledge of human performance, technology, and policy to evaluate and improve the safety, efficiency, and robustness of work systems. Quality and productivity measurement research determines the factors that drive productivity and quality operations, service, and engineering excellence. Quality management and improvement research focuses on improving planning, resource allocation, and management strategies in different sectors. Innovation and organizational change research attempts to understand effective approaches to organizational learning and design, strategic and cultural change, quality and process improvement, and the innovation and integration of new technologies. These key areas, as well as research initiatives in other related fields, drive much of modern quality research. They are frequently funded by federal agencies such as the National Science Foundation (NSF), corporate partners, and other organizations.

1.3. Quality Research Publications

The ASQ releases several magazines and other publications focusing on recent research, new methods, literature reviews, case study examples, and professional development initiatives within the quality community. These quality-focused publications are listed below.

- The *Journal for Quality and Participation* covers themes and topics such as leadership, employee involvement, and teamwork, which are all areas in which process improvement can affect quality, customer satisfaction, and organization performance. The *Journal for Quality and Participation* is a peer-reviewed, quarterly publication.

- The *Journal of Quality Technology* emphasizes the practical applicability of new statistical techniques on experiment design, process monitoring, reliability, and applied statistics. The *Journal of Quality Technology* is a peer-reviewed, quarterly publication.

- *Quality Engineering* targets professionals in all engineering and management fields interested in quality improvement, and contains research on quality control and quality assurance management, associated statistical tools, and standards information, among other topics. *Quality Engineering* is a peer-reviewed, quarterly publication.

- The *Quality Management Journal* aims to link the efforts of academic researchers and quality management practitioners by publishing significant research relevant to quality management practice. The *Quality Management Journal* is a peer-reviewed, quarterly publication.

- *Quality Progress* is ASQ's monthly membership magazine and flagship publication. It seeks to provide timely information about quality principles, tools, and techniques.

- *Six Sigma Forum Magazine* addresses the various professional development needs of Six Sigma executives, champions, master black belts, black belts, and green belts. *Six Sigma Forum Magazine* is a peer-reviewed, quarterly publication.

Researchers frequently publish in these journals, but they may also publish in engineering, statistics, or management-focused publications, as well as sector-specific journals or other non-ASQ publications such as *Quality Magazine,* the *International Journal of Quality Engineering and Technology,* or the *International Journal of Reliability, Quality and Safety Engineering*. In addition, recent quality research is often presented at local, national, and international conferences such as those held by the ASQ or by regional quality organizations. Through the many existing opportunities for research, publication, and transmission of knowledge, modern quality scholarship is a thriving field that enables professionals and scholars alike to improve their quality processes and strategies.

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