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Evolution of Quality: First Fifty Issues of *Production and Operations Management*

Roger G. Schroeder • Kevin Linderman • Dongli Zhang
Donaldson Chair in Operations Management and Co-Director, Joseph M. Juran Center for Leadership in Quality, Carlson School of Management, University of Minnesota, Minneapolis, Minnesota 55455, USA
Associate Professor in Operations and Management Science, Carlson School of Management, University of Minnesota, Minneapolis, Minnesota 55455, USA
Ph.D. Student in Operations and Management Science, Carlson School of Management, University of Minnesota, Minneapolis, Minnesota 55455, USA
rschroeder@csom.umn.edu • klinderman@csom.umn.edu • dzhang@csom.umn.edu

Many contributions have been made to the field of quality since the inaugural issue of *Production and Operations Management* in 1992. The first issue called for more research and teaching on TQM, which resulted in two special issues dedicated to TQM. Many other articles related to quality have also been published in the first fifty issues of the journal on topics ranging from technical methods to the Baldrige Award and ISO 9000. As we review these articles, we assess their contribution and the progression of the field of quality. Although past research has advanced our understanding of quality, there still exists many research opportunities in developing more theory, using additional research methodologies, and studying emerging topics in this field.

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1. Introduction

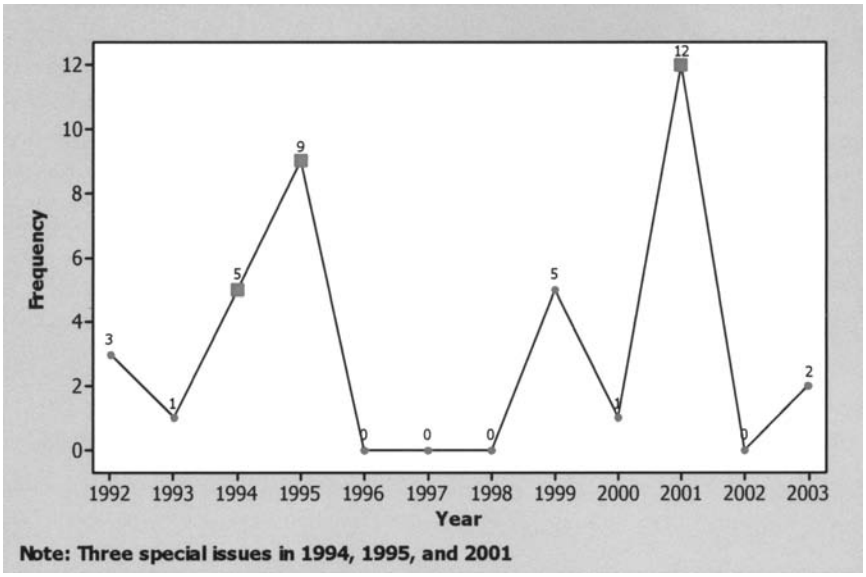
Thirty-eight papers on quality have appeared in the first 50 issues of *Production and Operations Management*. A graph of the number of articles published in each year is shown in Figure 1. The figure indicates a stream of publications with special issues being an important stimulus to publication of articles on quality.

The purpose of this article is to analyze all of the articles from the first fifty issues that pertain to quality and to suggest future directions for research that could be pursued. This is a challenging task since much has been written on quality in these fifty issues covering a wide variety of subjects and topics. In order to simplify the task, we will suggest a classification scheme to help analyze these articles and assess their contribution to knowledge about quality.

The inaugural issue of the journal in 1992 coincided with an important time in the history of the quality field. During the 1980's, industry had been going through far reaching changes that were dubbed Total Quality Management (TQM), primarily in response to the intense Japanese competition in U.S. markets. However, academics had not researched TQM, and were not teaching it in U.S. universities, finding themselves lagging industry practices. This spawned two letters, reprinted from the *Harvard Business Review*, and one article in the first issue of *Production and Operations Management* calling for more research and teaching about TQM and subsequently, the commissioning of two special issues on TQM and Quality that appeared in 1994 and 1995. The third special issue on Quality appeared later in 2001 and served to provide new research up to that time. These three special issues on quality contained 25 articles or about two-thirds of the total articles on quality in the first fifty issues.

Since TQM played such a major role in the early issues of *Production and Operations Management*, it is fitting to suggest a classification system for this section that begins with articles concerning the TQM paradigm. But, in the spirit of the journal reaching out to all audiences, a number of traditional technical articles have also appeared in the first fifty issues. The TQM

Figure 1 **Number of *POM* articles on quality by year.**



paradigm spawned interest and lead to several articles on the Baldrige and ISO 9000 frameworks that were emerging in the early 1990's. Finally, the first fifty issues contained articles related to human resources and quality, service quality, and quality and performance. This suggests the following categories that are used to organize the publications.

TQM Paradigm
Technical Tools
Baldrige, ISO 9000, and ISO 14000
Human Resources and Quality
Service Quality
Quality and Performance

While these categories can be used to organize past papers, they do not illuminate future directions needed. Therefore, we use the Baldrige framework later in this paper to suggest possible gaps in the literature and to provide fodder for future research.

2. Articles on Quality Management

2.1 Total Quality Management Paradigm

As mentioned earlier, the first issue of the journal in 1992 addressed a brewing controversy about TQM. While industry had been aggressively adopting TQM during the 1980's, the academic community was largely asleep on the topic to the consternation of the CEO's of major companies including Motorola, American Express, Ford Motor, Procter & Gamble, IBM, and Xerox. As a result, these CEO's signed a letter, reprinted from the *Harvard Business Review*, in the first issue of the journal calling for universities to take action and begin researching and teaching TQM in partnership with industry (Robinson et al. 1992). Singhal and Hayes (1992), also reprinted from the *Harvard Business Review*, gave a positive response to their call on behalf of the Production and Operations Management Society. This issue was rounded off by a perspectives piece on "The Quality Revolution" (Cole 1992). In it, Cole noted that our understanding of quality had undergone great changes in the last decade due to Japanese advances. This has rendered obsolete the traditional notion of tradeoffs, forcing a new understanding of cost-quality relationships.

The next significant article on the TQM paradigm appeared in volume 4, number 3, "Partial Quality Management: An Essay", written by Kolesar (1995). In his essay, he laments that companies are only half-heartedly implementing TQM. While executives tout the advantages of TQM, workers and mangers are not implementing the TQM paradigm at lower levels. His concern is that this will lead to the demise of TQM which, of course, proved to be prophetic.

In the same issue, Ahire, Landeros, and Golhar (1995) provide a TQM literature review and agenda for future research. This was a comprehensive survey of 226 TQM-related articles from 44 refereed management journals published between 1970 and 1993. Using the Baldrige framework, they were able to identify gaps in the literature that were in need of further research. These gaps included a lack of empirical research and the need for a better theoretical base. While these gaps have been filled to some extent particularly with more empirical research, the theoretical base is still lacking as discussed later.

Finally, this special issue contained an article on a TQM based incentive system that supports TQM implementation (Symons and Jacobs 1995). In this article, the authors provide a case study to demonstrate the

incremental effects on productivity and quality of implementing a TQM based incentive system that uses a variety of performance measures, including an explicit incentive for reduction in variability in product variables.

It wasn't until 2001 that the next two articles appeared on the TQM paradigm. The first article by Sousa and Voss (2001) provide a useful contingency-basis for quality management, rather than the universal approach. In their article, they show from empirical data that the quality practices adopted are a function of the strategy chosen.

Finally, Jack, Stephens, and Evans (2001) provide an integrative summary of doctoral level research in quality management. They demonstrate that doctoral dissertations on quality management accelerated starting in 1990, peaked in 1995, and then declined by 1998. They also noted that research in quality management had become more interdisciplinary, used more rigorous methodologies, and increased the use of theories from other disciplines. But, they observed, "quality management is no longer a 'hot button' topic; and many of the 'low hanging fruit' had been picked" (Jack, Stephens, and Evans, 2001, p. 380). They noted that TQM research had peaked as measured by Ph.D. dissertation output and was now being replaced by other topics.

Several major contributions to TQM were made during the first 50 issues. First, TQM was established as an important problem in industry that needed to be addressed by academics. Several doctoral dissertations were written in the early 1990's with a peak in dissertation output by 1995 (Jack, Stephens, and Evans, 2001). Also, scholarly review of the TQM literature has helped develop an organized conceptual understanding of quality and established a basis for developing a body of knowledge in the field of quality management.

During the same era, scholars publishing in other journals also contributed to the Total Quality Management paradigm. Dean and Bowen (1994), writing in the *Academy of Management Review,* begin to develop a theoretical definition of TQM, and argued that TQM consists of three fundamental concepts—customer satisfaction, continuous improvement, and teamwork. They noted that TQM could be better informed by more management theory. Anderson, Rungtusanatham, and Schroeder (1994) draw on management theory to develop a theory underlying Deming's management method. Hackman and Wageman (1995) addressed the issue of whether or not the TQM paradigm exhibits discriminate and convergent validity. By analyzing the content of TQM, they argue that TQM does demonstrate discriminate and convergent validity, but could lose discriminate validity from management theory as TQM becomes more expansive. Flynn, Schroeder, and Sakakibara (1994) developed perceptual scales to empirically measure concepts related to TQM.

2.2 Technical Tools

Some of the first breakthroughs in quality management occurred with the development of technical tools. Shewhart's (1939) original work on the development of Statistical Process Control (SPC) and the PDCA (Plan Do Check Act) cycle had a profound affect of the field. Even though the first publications on technical tools date back to the 1930's, advancements are still being made today. The first technical article in *Production and Operations Management* appeared in volume 2. In this article, Sahin (1993) studies the impact of conformance quality on manufacturer's and user's replacement costs while the product is under warranty. He also discusses the value of inspection and presents an application based on real data.

In volume 3, Moskowitz, Plante, and Wardell (1994) published an article entitled: "Using run-length distributions of control charts to detect false alarms." They show how the run-length probability distribution can be used to detect out of control points on control charts instead of the commonly used average run-length. They demonstrate that average-run length alone as a guide for determining whether a signal is a false alarm or otherwise can be misleading.

Singhal (1995) in his introduction to volume 4, number 3, noted this special issue was devoted to developing sophisticated quality improvement approaches through business-academe collaborations. In this issue, three technical papers appeared. The first was a paper by Cox, Bell, and Glover (1995) that demonstrated a new customer service data-driven learning approach to process improvement. In cooperation with U.S. West, they developed the approach that used an artificial intelligence statistical tree growing method to analyze complex customer service data. Their objective was to analyze data rapidly to identify the areas in which more careful study should yield the greatest benefits in process design and improvement.

Chen and Tirupati (1995) showed how integrating product inspection and process control could reduce quality costs. They use process-status information (based on process control) in making product-inspection decisions. Their work was motivated by the operations of a wafer fabrication facility of a semiconductor manufacturer.

Finally, Alwan and Radson (1995) in this special issue discuss implementing time-series based statistical process control. A practical limitation on the use of time-series modeling is that its implementation requires sophisticated statistical skills, whereas standard control charts use only elementary statistical knowledge. This choice raises questions of manage-

ment philosophy, statistical techniques, and computation that the authors address.

It wasn't until five years later in 2000 that another technical article appeared on quality by Kanyamibwa and Ord (2000), "Economic process control under uncertainty." They developed a loss function approach that enables derivation of optimal sampling and inspection policies as well as deciding whether to adjust the process or to continue production without adjustment. They allowed for variability in the production process and for the possibility of both continuous mean shift and variance deterioration within the production run. This addresses some of the limitations of previous control chart approaches.

Although the technical aspects of quality management have been well studied, *Production and Operations Management* has helped advance this important area of quality. More in-depth analysis of quality tools (e.g., SPC) has helped us understand the implications of implementing these techniques. In addition, decision-making tools for inspection, maintenance, adjustment, and equipment replacement were developed aimed at improving coordination and taking into account economic information.

Many published works from other journals have also contributed to the advancement of technical tools in quality management where research on technical tools is extensive and well developed. The following articles give an overview of technical tools in quality and suggest future research directions. Box (1996) gives an overview of the role of statistics and the scientific method in quality improvement. Woodall and Montgomery (1999) discuss future research directions for Statistical Process Control. Some fruitful areas for research are control charts for short production runs, multivariate control charts and control charts for auto-correlated production processes. Carlyle and Montgomery (2000) discuss the use of optimization methods and statistics to aid in quality improvement. Software reliability also offers another future research opportunity to apply technical tools of quality. In addition, homeland security issues present new opportunities to study advanced sampling and inspection procedures. This could include investigating Bayesian approaches to inspection and considering the role of inspection errors.

2.3 Baldrige, ISO 9000, and ISO 14000

At the same time that interest in TQM was emerging, Baldrige and ISO 9000 were receiving considerable research attention, along with the environmental standard ISO 14000. Singhal (1994), the editor of the first special issue on Quality Management, noted that TQM had emerged in response to Japanese competition and introduced several articles aimed at responding to these competitive issues. One of these articles by Reimann and Hertz (1994) compared the Baldrige Award and ISO 9000. In their article, they pointed out that the Baldrige Award is aimed at enhanced competitiveness while ISO 9000, at that time, was concerned primarily with conformance to specifications. Competitiveness factors addressed by Baldrige that were not considered by ISO 9000 in 1994 were customer and market focus, results orientation, continuous improvement, competitive comparisons, a tie to business strategy, cycle time and responsiveness, integration via analysis, public responsibility, human resource development, and information sharing. Note, since the Reimann and Hertz article appeared, ISO 9000:2000 was issued and has narrowed some of these differences.

In volume 8, Anderson, Daly and Johnson (1999) analyze why firms seek ISO 9000 certification: regulatory compliance or competitive advantage? Their results support the proponents of ISO 9000 who claim that it is a low-cost signal of a firm's commitment to quality. After controlling for regulatory and customer pressures to obtain ISO 9000, other factors related to quality management and quality-based competition explain the adoption decision.

In volume 10, Angell (2001) compares the environmental and quality initiatives of Baldrige Award winners. While the literature suggests that quality and environmental programs are closely related, this study finds that drivers of environmental initiatives are not the same as those for successful quality initiatives. For example, while top management support seems necessary for quality initiatives, it is neither necessary nor sufficient for environmental programs.

Pil and Rothenberg (2003) study environmental performance as a driver of superior quality. They highlight the synergistic and reciprocal nature of environmental and broader manufacturing improvement programs. Firms that have attained superior performance regarding the environment are able to leverage those efforts to enhance their quality.

The first 50 issues of the journal made significant contributions to quality frameworks and standards, which include: differentiating between them, identifying the motives for adoption, and determining the performance implications. In addition, scholars found synergies between quality management practices and environmental concerns. As we can see, the relationship between programs such as Baldrige, ISO 9000, and ISO 14000 continue to be a source of fruitful research. There is still much work to be done to understand the many connections that are present.

Besides these papers in *Production and Operations Management*, several publications in other journals have contributed to our understanding of quality management frameworks and standards. Flynn and Saladin (2002) investigate how the Baldrige frame-

work has been adapted over the years using path analysis. They found empirical support that major updates in the Baldrige framework tended to show improvements. Meyer and Collier (2001) find empirical support for the applicability of the Baldrige framework to the healthcare setting. Guler, Guillen, and Macpherson (2002) used panel data to study the diffusion of ISO 9000. Drawing on institutional theory and social network theory, they find patterns of adoption of ISO 9000 based on competition, regulatory environment, and cohesive social networks.

2.4 Human Issues

Production and Operations Management has published some leading edge articles on human issues starting with an article by Gupta and Ash (1994) on "Excellence at Rohm and Haas Kentucky: A case study of work-team introduction in manufacturing." Their study documents the use of self-regulating teams that make most of their own decisions about the work they do and the interface with customers. The results have been increases in productivity, a decline in worker grievances and turnover and an improvement in the safety record.

Stewart and Chase (1999) make an important contribution to the understanding of the impact of human error on delivering service quality. Contrary to popular opinion, they take the position that a substantial portion of service failures is the result of human error in the delivery process. The paper identifies the most prevalent cognitive error mechanisms in services and reveals that the types of errors leading to service failure tend to be generally predictable.

In a closely related article, Stewart and Grout (2001) address the human side of mistake-proofing. They utilize the poka-yoke (mistake-proofing) approach that uses relatively simple devices to achieve marked improvements. Their paper provides an academic underpinning to the largely anecdotal mistake-proofing literature.

Kathuria and Davis (2001) round out this collection of articles by addressing the managerial performance implications of work force management practices. They show that work force management practices (e.g. mentoring, inspiring, supporting, and rewarding) enhance managerial performance particularly when an emphasis is placed on quality in meeting customer needs through accurate, consistent, and reliable products.

Several significant contributions have been made to quality management and human issues in the first 50 issues. The appropriate allocation of decision authority to quality teams can lead to higher levels of performance. In addition, the use of several human resource practices enhances performance. However, human error can also be the source of several quality problems, especially in the service environment. As we shall note later, research in human resources presents a great opportunity for further insights, and draws on the vast literature in organizational behavior. This literature can be used to develop interesting insights into implementation, change management, goals, culture, and other issues that affect quality.

Important contributions to quality and human issues in other journals occurred around the same time. Dean and Snell (1992) found that selective staffing, equitable awards, comprehensive training, and developmental appraisals all contribute to the efficacy of quality management programs. Detert, Schroeder, and Mauriel (2000) identified dimensions of organizational culture that correspond to the values and beliefs in quality management. This was followed by the development of a survey instrument of quality and culture in an educational setting (Detert, Schroeder, Cudeck 2003). Victor, Boynton, and Stephens-Jahng (2000) investigated the role conflict that workers experience in TQM. Line employees' work requires both standardized production and continuous improvement, which can result in increased role conflict and stress. However, designing work that can facilitate switching between roles can mitigate the negative consequences of having dual roles. Rungtusanatham (2001) found that effective implementation of SPC creates more enriched jobs that lead to higher levels of worker motivation and job satisfaction. Finally, Linderman, Schroeder, Zaheer, and Choo (2003) argued that effective use of project goals results in higher motivation that leads to higher levels of performance in Six Sigma teams.

2.5 Service Quality

There have been a number of articles on quality that have appeared in special issues on managing service operations. For example, in volume 8, Soteriou and Hadjinicola (1999) discuss resource allocation to improve service quality perceptions in multistage service systems. They combine marketing and operations viewpoints in a model that provides optimal resource allocation. In the same volume, Dube, Johnson, and Renaghan (1999) adapt the QFD approach to extended service transactions. They show how to incorporate higher-level customer needs (consequences, experiences and personal values) into the process and illustrate their approach for the luxury hotel business.

The special issue on quality in volume 10 contains a longitudinal study of the effect of a service guarantee on service quality by Hays and Hill (2001a). While the service guarantee did not have a direct effect on learning, it did have a positive effect on service quality primarily through its positive effect on employee motivation and vision.

The special issue on service in volume 12 contains

an article by Stewart (2003) on designing the service encounter for improved quality. He provides a framework supported by case evidence for organizing the growing body of service quality literature related to service encounter design.

Several contributions were made to service quality in the first fifty issues of the journal. Specifically designing and implementing policies and procedures to improve service operations have been investigated. Service quality should continue to be a fruitful and emerging area of research for operations management scholars.

Other journals made several other important contributions to service quality around the same time. Zeithaml, Berry, and Parasuraman (1996) investigate customers' behavioral responses to service quality. They find that improving service quality can increase favorable behavioral intentions (loyalty) and decrease unfavorable intentions (defection). Hays and Hill (2001b) find that higher levels of motivation/vision and organizational learning positively affect service quality. Several scholars have investigated measurement issues related to service quality. Fornell, Johnson, Anderson, Jaesung, and Bryant (1996) describe the nature and purpose of the American Customer Satisfaction Index (ACSI), and find that customer satisfaction is more quality-driven than price-driven. Several scholars have also been working to refine SERVQUAL, a measurement instrument for service quality (Parasuraman, Zeithaml, and Berry 1988; 1994; Parasuraman, Berry, and Zeithaml 1993).

2.6 Quality and Performance

More articles have appeared in *Production and Operations Management* on Quality and Performance than any other category. In the first special issue on quality in volume 3, Ittner (1994) published an examination of the indirect productivity gains from quality improvement. He showed that the indirect effects through process improvements and reduced factory congestion provided at least two to three times the direct benefits attributable to lower scrap, rework, and inventory holding costs. Therefore, managers should be aware of the full impact of quality improvements.

In the second special issue on quality in volume 4, Lester (1995) provided information on industry studies and American industrial performance sponsored by the Sloan Foundation. This is a particularly aggressive research program including 10 universities, scores of faculty, and more than 100 graduate students focused on the study of performance and practices in 10 different industries. Their findings about industry-based performance are far reaching including empirical evidence that firms should adopt not only one or two innovative human resource practices, but a full range of practices such as incentive schemes, work organization, training, employment security, labor-management relations, employee-involvement programs, and the like. They also argue that scholars need to develop industry specific knowledge by intensive industry focused research studies.

In the same issue, Benson, Cunningham, and Leachman (1995) benchmark manufacturing performance in the semiconductor industry. They describe the development of seven metrics designed to measure the quality and productivity of semiconductor manufacturing. Multivariate statistical analysis of these metrics shows that they measure independent aspects of performance and expose significant differences.

Dow, Samson, and Ford (1999) write on "Exploding the myth: do all quality management practices contribute to superior quality performance." In a large-scale empirical study they show that practices such as employee commitment, shared vision and customer focus contribute to superior quality outcomes. Conversely, other quality practices such as benchmarking, cellular work teams, advanced manufacturing technologies and close supplier relations do not contribute to superior quality outcomes.

In the third special issue on quality management, four articles appear on quality and performance. In the introduction to this issue, the editors Flynn and Schroeder (2001) point out the changing nature of research in quality and new initiatives in the quality field. This is reinforced in a letter by Starr (2001) who reflects on safety and security after September 11, 2001, and the resulting effect on quality goals for both product and process.

The first of the four articles on performance in this special issue by Devaraj, Matta, and Conlon (2001) investigates the antecedents of customer loyalty in the automotive industry. They show how product quality, service satisfaction, and customer beliefs all contribute to customer loyalty. This is the first study that has examined both product quality and service quality as antecedents to customer loyalty.

In a qualitative study, Dostaler (2001) investigates the cumulative and tradeoff theories of manufacturing performance. This paper compares the cases of two British contract electronics assemblers. She argues that while performance measures are related to each other a sequential relationship may not be necessary.

Fynes and Voss (2001) develop a path analytic model of quality practices, quality performance, and business performance. This study shows how both design quality and conformance quality, along with external quality-in-use and cost, are related to customer satisfaction and then business performance based on a sample of 200 electronics suppliers in Ireland.

In the last article in this special issue, Narasimhan and Mendez (2001) provide a theoretical analysis of the strategic aspects of quality. The paper first deter-

mines whether a stable relationship among price, aspects of quality, and the sales rate exists by examining equilibrium properties of their model. They comment on quality-based strategic options a firm must consider to ensure long run growth and profitability.

Several contributions were made in the first fifty issues of *Production and Operations Management*. Quality management has several indirect benefits not previously identified in the literature. In addition, various quality management practices affect performance differently. Finally, the relationship between quality management and performance is complex and needs to be considered within the strategic context of the firm.

Other journals also contributed important works on quality and performance during this time. Hendricks and Singhal (2001a; 2001b; 1997; 1996) produced a series of articles that addressed effective implementation of quality management and firm performance. They found significant improvement in firm performance occurred about five years after effectively implementing TQM. However, they did not observe much improvement in firm performance in the short-run, suggesting that TQM requires a long-term commitment. Flynn, Schroeder, and Sakakibara (1995) discriminate between quality management infrastructure and core practices. They found that quality management core practices mediate the relationship between quality infrastructure practices and quality performance. Powell (1995) argues that the technical tools and techniques of TQM do not produce a competitive advantage, but that tacit aspects of TQM such as employee empowerment, executive commitment, and an open culture do contribute to a competitive advantage. Kaynak (2003) reviews the literature on quality management and firm performance and notes several inconsistencies between different scholars.

3. Research Methods in Quality Management

Since various research methods have been employed to study quality over the first fifty issues, we classify the papers according to the research methodology employed along with the topic addressed. Three of these articles are letters (Robinson et al. 1992; Singhal and Hayes 1992; Starr 2001). Our classification excluded these three letters and focused on the remaining 35 articles. Our analysis showed that these articles were written with one of the following methods: overview, theory, case study, empirical, analytical, or literature review. We classified an article as overview if the article addresses general aspects of quality in a holistic manner. For example, we classified "The Quality Revolution" (Cole 1992) as an overview article. We also classified the three introduction articles on the special issues as overview articles (Singhal 1994; Singhal 1995; Flynn and Schroeder 2001). If the articles include topics such as a theoretical underpinning to practical phenomenon or prescriptive models, we classified them as theory articles. One example of an article with a theoretic orientation is Stewart and Grout (2001). In their research on mistake-proofing, they draw upon theory from psychology and cognitive science to explain human error. Articles with a case study orientation present detailed studies on only a few organizations. An empirical article is based on a study of a large number of organizations, or units of observation, and uses statistical analysis. While case studies are generally aimed at theory generation, empirical research is aimed at theory testing (Eisenhardt 1989). We classified articles as analytical if they use analytical techniques. There are also a few literature review articles on quality in the first fifty issues. The result of this classification is summarized in Table 1.

From the table, it can be seen that empirical articles have provided the major emphasis in published quality research in the first fifty issues (11 out of 35). Also the analytical method is a major technique that has been used in many articles (8 out of 35). The heavy emphasis on empirical articles shows that empirical testing has been widely used in quality research which is different from that used for research 10 years ago (Ahire et al. 1995).

Table 1 Quality Management Topic and Research Method

Research method	Topic						
Frequency	TQM	Technical Tools	Baldrige, ISO9000	Human Issues	Service Quality	Quality and Performance	Total
Overview	5		1			1	7
Theory				1			1
Case study	1		1	1	1	2	6
Empirical	1		2	2	2	4	11
Analytical		6			1	1	8
Literature review	2						2
Experimental							0
Total	9	6	4	4	4	8	35

Table 1 indicates that a number of studies have employed either analytical or empirical methods. However, none of the studies in the last fifty issues have empirically tested analytical models. Future research in quality management can empirically test the analytical models that have been developed over the years. One opportunity might be to empirically test the Taguchi Loss function. Anecdotal evidence supports the Taguchi Loss function (Taguchi and Clausing 1990), but is has never been tested using rigorous empirical research methods.

Another finding of this analysis is that there are no quality articles using an experimental method in the first fifty issues. Although the experimental method is relatively new to quality management, some Operations Management scholars have begun to employ experiments (e.g., Croson and Donohue 2003; Schultz, Juran, and Boudreau 1999; Schultz and Juran 1998).

Quality, as an interdisciplinary field, also draws heavily from other fields such as organizational behavior, knowledge management, human resource management, and marketing. Thus, conducting quality research from an inter-disciplinary perspective has fruitful potential. For example, one promising future research direction could be incorporating behavioral theory in the quality field, since the interaction between human motivation and quality management practices might better explain performance. As we mentioned above, there are no quality articles in the first fifty issues using the experimental method. This is a potential technique that can be used when incorporating behavioral theory in quality research.

Another finding is the lack of theory development underlying quality management. Theory is fundamental to developing scientific knowledge and the basis for developing empirically testable hypotheses. A scientific body of knowledge on quality management will not emerge without adequate theory development. Several theories from the management literature can help develop a theoretical basis for quality management. For example, the Resource Based View (RBV) of the firm maintains that the goal of firms is sustained competitive advantage, which is based on the possession of resources by the firm that are rare, valuable, inimitable, and non-substitutable (Barney 1991; Peteraf 1993). The inimitability and non-substitutability of these resources helps the firm earn higher profits, sustained over time, as the firm resists attempts by competitors to duplicate these resources. Successful implementation of quality practices could be viewed as a valuable and a rare resource that is inimitable. Institutional theory (Scott 1995) could be seen as a contrasting theory, which notes that over time organizations begin to look the same. Implementing ISO 9000 can be understood from an institutional theory perspective (Guler, Guillén, and Macpherson 2002). Requiring organizations to get ISO 9000 certification creates coercive forces that makes quality management systems isomorphic to one another. This perspective contrasts with the resource-based view of a firm that emphasizes unique approaches. These contrasting theories lead to the question of whether quality is a source of competitive advantage, and if so, how and why?

4. New Directions for Research

Looking at the published research in the first fifty issues, there are some topics that are diminishing and others are likely to be increasing. TQM, for example, is no longer an active research area. Baldrige and ISO are also likely to diminish in their research importance, since they have been extensively studied in *Production and Operations Management* and other journals. Even though there has been much written on the connection between quality and performance, there will still be some interest in researching this connection from different perspectives and with different methods. We can also expect research on technical aspects of quality to continue, and perhaps there will be increasing interest in both human issues and service quality.

It may be insightful to review the categories in the Baldrige Award and compare them to the past research in quality. The Baldrige Criteria for Performance Excellence (NIST 2005) lists the following categories for the Award.

1. Leadership
2. Strategic Planning
3. Customer and Market Focus
4. Measurement, Analysis, and Knowledge Management
5. Human Resource Focus
6. Process Management
7. Business Results

As we can see, the predominance of research has been done in category 6 (process management) and category 7 (business results) with some research also done in category 5 (human resources). But, categories 1 to 4 are almost devoid of research that connects these topics to the quality field. The area of leadership, for example, has been widely studied in the management literature, but little of that research has been brought to bear in the quality field. A similar claim can be made about Strategic Planning, Customer and Market Focus and Measurement, Analysis, and Knowledge Management. While much research has been done on these topics in the general management field, the theory and results have not been linked to quality management specifically. We will develop some possible research directions for these four Baldrige areas starting with leadership.

4.1 Leadership

Some academic research has supported the notion that top management leadership is necessary for quality improvement (Benson et al. 1991; Flynn et al. 1995). But, what kind of leadership is most effective and how can leadership not only initiate quality efforts but also sustain them once started?

The Baldrige criterion supports the concept of visionary leadership as part of its core values, where senior leaders provide inspiration to the work force (NIST 2005). Visionary leadership is similar to transformational leadership and opposed to transactional leadership (Bass 1985; Kuhnert and Lewis 1987). Most of the research in quality management and leadership has focused on transformational leadership (Anderson et al. 1994).

However, other emerging themes in leadership also provide research opportunities for quality. For example, Emotional Intelligence (EI) theory is an emergent theory relevant to quality management (Evan and Lindsay 2005; p. 213). This theory argues that successful leaders have five key components: self-awareness, self-management, self-motivation, empathy, and social skills (Goleman 1998; George 2003). Trust is another emergent issue in leadership. Trust is the positive expectation that another will not act opportunistically (Robbins 2003; p. 336). Leaders can help create a climate of trust that promotes cross-functional collaboration (Webber 2002). Research in quality management can investigate how emotional intelligence and trust engendered by leaders can affect quality performance.

Another important area of research is leadership development and succession planning. General Electric uses Six Sigma as a vehicle to develop the future leaders of the organization (Welch and Byrne 2001). Black Belts develop important change management skills, which help them prepare for more senior leadership positions. Related to leadership development is succession planning. During the Juran Summit in 2002, Don Peterson, former CEO of Ford, argued that Ford lost its quality advantage because he did not properly educate the board of directors on quality. As a result, quality was not given enough consideration when selecting the next leaders. Future research could examine the role of leadership development and succession planning in quality management.

4.2 Strategic Planning

Promising research in the quality strategy area is the application of configuration and contingency theory. While quality strategy has been proposed as largely universal in nature, there are some preliminary studies of contingencies that show that the content of quality strategy is contingent on the environment and other factors (Sousa 2003; Neil 1996). Contingencies related to the size of the organization, environmental uncertainty, and dynamism could all be expected to affect the process and content of quality strategy. Furthermore, the quality practices themselves are contingent on the strategy adopted, so there is a chain of contingencies.

Another fruitful area of research is to view quality strategy as a valuable resource that cannot be easily copied or imitated. Studies could draw on the Resource Based View (RBV) to identify what aspects of a quality strategy might provide a sustainable competitive advantage (Barney 1991). For example, it might be important to embed the strategy deeply into the organization in order for it to be relatively safe from duplication. Also, quality strategies that are never static and constantly being updated not only respond to a changing environment, but also are difficult to imitate.

More in-depth research cases are needed to provide examples of both the content and process for developing quality strategy. The cases should be aimed at defining in detail typologies and taxonomies of quality strategy content that can be used by researchers. They could also develop hypotheses for testing the content of quality strategy and the process. One example of this kind of case research developed nine cases of quality strategy and structural configurations (Shani and Rogberg 1994).

4.3 Customer and Market Focus

Customer and market focus is a topic that has been heavily researched from a marketing perspective. Research in the marketing field focuses on identifying customer needs and measuring customer satisfaction. The link between customer needs and internal operating processes is only tangentially considered in the marketing literature. However, today's market environment, which is characterized by diverse customer needs and rapid market changes, presents major challenges to operations. Research that links customer needs and internal operating processes is now emerging in the Operations Management field, such as research on agility, responsiveness, and mass customization (e.g., Gunasekaran and Yusuf 2002; Tu et al. 2001). This provides a fruitful area for quality management research, since these topics have not been linked to quality management specifically. Sousa (2003) makes an effort to establish the link and identifies several customer focus practices. The main finding of his research is that customer focus practices are contingent on a plant's manufacturing strategy. However, more studies are needed to address the role and new challenges of quality management when firms are trying to create a high degree of flexibility and responsiveness to changing customer/market requirements. Potential theories that can be used in this area could be contingency theory and the Resource Based View.

4.4 Measurement

Some research has been done in the area of measurement and analysis for quality management, but there are still opportunities for further work. For example, two topics that could be pursued are the balanced score card and process dashboards.

The balanced score card (BSC) has gained much currency in accounting and management research (Kaplan and Norton 1996). Emergent research has been done on the relationship of the BSC to quality management (Bell and Elkins 2004; Hoque 2003), but the precise connection with quality practices and principles needs more study. A configuration or contingency approach could be used to show what kind of balanced score cards are appropriate for what types and sizes of organizations.

Another research area for measurement of quality is through the use of process dashboards. An interesting study by Debusk, Brown, and Killough (2003) demonstrated through an experimental design that dashboards are most useful in providing operational information that depends heavily on the situation. Bottom line financial measures such as profit and return on investment, while perceived more important than their non-financial counterparts, were viewed as outcomes to be achieved by controlling operational measures. Since process dashboards are connected to Six Sigma applications and the Baldrige Award, dashboards are an area of research of interest to both researchers and industry (Dover 2004).

4.5 General Topics for Research

As can be seen, the research opportunities in the quality field are abundant. But, one emerging topic that has intense interest in industry is Six Sigma. While very little research has appeared on this topic in any of the research journals, many books and articles have appeared in the practitioner literature (Linderman et al. 2003). Working papers, proceedings, and national conference presentations are beginning to appear and we can expect many research publications on Six Sigma in the coming years, perhaps similar to the surge in research on TQM that occurred in the 1990's.

The area of quality management is ripe for application of theories from general management, as well as development of new theories. We have already seen some articles that utilize contingency theory, human resource theories, economic theories, and statistical process control theory. We can expect to see more theory-based research in the future as researchers not only describe quality management practices, but also seek to explain how and why they occur. Existing management theories that could be applied, for example, are institutional theory (Scott 1995; Meyer and Rowan 1977), the resource-based view (Barney 1991; Peteraf 1993), resource dependency theory (Pfeffer and Salancik 1978; Ulrich and Barney 1984), and the transaction cost theory (Williamson 1993; 1996), to name only a few.

Quality management is a field that requires a continuity of research over time. While fads come and go in industry (Abrahamson 1996), the quality field needs to maintain a base of research beyond the hot practice of the day (Zbaracki 1998). For example, quality circles and TQM have come and gone, and now the latest fad is Six Sigma. Maintaining a base of research requires an infrastructure of academic inquiry and theory building that transcends, but yet illuminates current connections with industry fads. It is the hope of the authors that *Production and Operations Management* will continue to lead the way in publishing cutting edge research in the quality field that maintains the momentum and base that has been established.

Appendix A A Listing of Articles on Quality in the first 50 Issues of *POM*

Year	Volume	Issue	Start Page	Authors	Title	Topic	Research Method
1992	1	1	118	Robert E. Cole	The Quality Revolution	TQM	Overview
	1	1	121	James D. Robinson III, Harold A. Poling, John F. Akers, Robert W. Galving, Edwin L. Artzt, and Paul A. Allaire	An Open Letter: TQM on Campus (reprinted from *Harvard Business Review*, November/December 1991, pp. 94–95.)		*
	1	1	124	Kalyan Singhal and Robert Hayes	An Open Response to "TQM on the Campus"; We Need TQM . . . and More (reprinted from *Harvard Business Review*, January/February 1992, p. 148.		*
1993	2	4	242	Izzet Sahin	Conformance Quality and Replacement Costs Under Warranty	Technical	Analytical
1994	3	3	149	Kalyan Singhal	Implementing Initiatives on Quality: An Introduction to the Special Issue on Total Quality Management	TQM	Overview
	3	3	153	Christopher D. Ittner	An Examination of the Indirect Productivity Gains from Quality Improvement	Performance	Case study
	3	3	171	Curt W. Reimann and Harry S. Hertz	Understanding the Important Differences Between the Malcolm Baldrige National Quality Award and ISO 9000 Registration	Baldrige, ISO9000	Overview

Appendix A *(cont'd)*

Year	Volume	Issue	Start Page	Authors	Title	Topic	Research Method
	3	3	186	Yash P. Gupta and Daniel Ash	Excellence at Rohm and Haas Kentucky: A Case Study of Work-Team Introduction in Manufacturing	Human Issues	Case study
	3	3	217	Herbert Moskowitz, Robert D. Plante, and Don G. Wardell	Using Run-Length Distributions of Control Charts to Detect False Alarms	Technical	Analytical
1995	4	3	183	Kalyan Singhal	Developing Sophisticated Quality Improvement Approaches through Business-Academe Collaborations: Introduction to the Special Issue	TQM	Overview
	4	3	187	Richard K. Lester	Industry Studies and American Industrial Performance	Performance	Overview
	4	3	195	Peter Kolesar	Partial Quality Management: An Essay	TQM	Overview
	4	3	201	Robert F. Benson, Sean P. Cunningham, and Robert C. Leachman	Benchmarking Manufacturing Performance in the Semiconductor Industry	Performance	Empirical
	4	3	217	Tony Cox, George Bell, and Fred Glover	A New Learning Approach to Process Improvement in a Telecommunications Company	Technical	Analytical
	4	3	228	Richard T. Symons and Raymond A. Jacobs	A Total Quality Management-Based Incentive System Supporting Total Quality Management Implementation	TQM	Case study
	4	3	242	Wen-Hsien Chen and Devanath Tirupati	On-Line Quality Management: Integration of Product Inspection and Process Control	Technical	Analytical
	4	3	263	Layth C. Alwan and Darrell Radson	Implementation Issues of Time-Series Based Statistical Process Control	Technical	Analytical
	4	3	277	Sanjay L. Ahire, Robert Landeros, and Damodar Y. Golhar	Total Quality Management: A Literature Review and an Agenda for Future Research	TQM	Literature review
1999	8	1	1	Douglas Dow, Danny Samson, and Steve Ford	Exploding the Myth: Do All Quality Management Practices Contribute to Superior Quality Performance?	Performance	Empirical
	8	1	28	Shannon W. Anderson, J. Daniel Daly, and Marilyn F. Johnson	Why Firms Seek ISO 9000 Certification: Regulatory Compliance or Competitive Advantage?	Baldrige, ISO9000	Empirical
	8	3	240	Andreas C. Soteriou and George C. Hadjinicola	Resource Allocation to Improve Service Quality Perceptions in Multistage Service Systems	Service quality	Analytical
	8	3	264	Douglas M. Stewart and Richard B. Chase	The Impact of Human Error on Delivering Service Quality	Human issues	Empirical
	8	3	318	Laurette Dube, Michael D. Johnson, and Leo Mark Renaghan	Adapting the QFD Approach to Extended Service Transactions Service Typologies: A State of the Art Survey	Service quality	Empirical
2000	9	2	184	Felicien Kanyamibwa and J. Keith Ord	Economic Process Control Under Uncertainty	Technical	Analytical
2001	10	3	306	Linda C. Angell	Comparing the Environmental and Quality Initiatives of Baldrige Award Winners	Baldrige, ISO9000	Case study
	10	4	359	Barbara B. Flynn and Roger G. Schroeder	Introduction to the Special Issue on Quality	TQM	Overview
	10	4	361	Martin K. Starr	Safety and Security: Critical Qualities Call for Refocusing POM		*
	10	4	363	Erick P. Jack, Paul R. Stephens, and James R. Evans	An Integrative Summary of Doctoral Dissertation Research in Quality Management	TQM	Literature review
	10	4	383	Rui Sousa and Christopher A. Voss	Quality Management: Universal of Context Dependent: An Empirical Investigation Across the Manufacturing Strategy Spectrum	TQM	Empirical
	10	4	405	Julie M. Hays and Arthur V. Hill	A Longitudinal Study of the Effect of a Service Guarantee on Service Quality	Service quality	Empirical
	10	4	424	Sarv Devaraj, Khalil Matta, and Edward Conlon	Product and Service Quality: The Antecedents of Customer Loyalty in the Automotive Industry	Performance	Empirical
	10	4	440	Douglas M. Stewart and John R. Grout	The Human Side of Mistake-proofing	Human issue	Theory
	10	4	460	Ravi Kathuria and Elizabeth B. Davis	Quality and Work Force Management Practices: The Managerial Performance Implication	Human issue	Empirical
	10	4	478	Isabelle Dostaler	Beyond Practices: A Qualitative Inquiry into High Performance Electronics Assembly	Performance	Case study
	10	4	494	Brian Fynes and Christopher Voss	A Path Analytic Model of Quality Practices, Quality Performance and Business Performance	Performance	Empirical
	10	4	514	Ram Narasimhan and David Mendez	Strategic Aspects of Quality: A Theoretical Analysis	Performance	Analytical
2003	12	2	246	Douglas M. Stewart	Piecing Together Service Quality: A Framework for Robust Service	Service quality	Case study
	12	3	404	Frits K. Pil and Sandra Rothenberg	Environmental Performance as a Driver of Superior Quality	Baldrige, ISO9000	Empirical

*denotes a letter.

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