The impact of quality circles on employee work behaviors: a cross-organizational study

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The impact of quality circles on employee work behaviors: A cross-organizational study

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Iowa State University, 1987
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The impact of quality circles on employee work behaviors:  
A cross-organizational study

by

Kimberly Kreisler Buch

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INTRODUCTION

In recent years the term "Quality of Work Life" has been used to describe values believed to have been long overlooked by industrial societies in general and by American management in particular. These values relate to the quality of human experiences in the work place. At the same time there has been growing concern over the economic malaise resulting from declining productivity and an increasingly competitive world market. These dual concerns have caused an unprecedented explosion of popular, practitioner, and academic interest in work innovations that attempt to improve both productivity and the quality of work life. Work innovation is a generic term used to encompass efforts to create more challenging, satisfying work and improve organizational effectiveness through the maximum utilization of individuals' skills and talents.

In the following section, the specific economic and societal factors which provided the impetus for this movement will be discussed, and the diversity of techniques included under the work innovation umbrella will be identified. The remainder of the review will focus on a single technique: quality circles, currently the most widespread and fastest growing form of work innovation. The history of quality circles (QC) will be traced from their origins in Japan to their adoption and evolution in the United States, and QC
structure and process will be discussed. Finally, the QC assessment literature, both anecdotal and empirical, will be reviewed.
Traditionally, it has been the duty of workers to do and the duty of managers to think. Such a division of labor has dominated the American workplace since the scientific principles of management were introduced by Frederick Taylor over 80 years ago. According to Taylor, the best way to manage people and to maximize their productive output was through "the plum and the lash"; reduce manual operations to a set of reliable motions allowing no personal discretion and reward obedient workers with bigger paychecks (Simmons & Mares, 1983). This system, according to Taylor, would benefit both employer and employee, the former with increased efficiency and control, the latter with better wages.

Although Taylor's ideas have dominated industrial practice throughout this century, they have not gone unchallenged. The phrase "industrial democracy" appeared as early as the 1920s, though its support in America did not match that received in Europe. Then came the famous experiments at Hawthorne Electric that spawned the Human Relations School of Management, which was to become the first real American challenge to Taylorism. The Hawthorne discoveries were followed by another important movement away from Tayloristic principles, a joint union-management profit sharing plan devised by Joseph Scanlon in the late 1930s.

The Human Relations movement influenced behavioral
science thinking by focusing on the social and psychological, rather than merely the economic, aspects of work. However, it did not replace the widespread practice of scientific management, which was to fall under renewed attack in the 1960s with the introduction of Theory X and Theory Y (McGregor, 1960). McGregor, Herzberg and other "neo-Human Relations" theorists of the sixties emphasized the importance of worker satisfaction and autonomy and popularized the concept of job enrichment. Meanwhile, a movement in Europe was pushing even stronger in the direction of participative management. Eric Trist's work at the Tavistock Work Research Institute in the 1950s produced the socio-technical system, an approach to work design which was the antithesis of Tayloristic job simplification and managerial control. During the 1960s Einar Thorsrud in Norway and other European work reformists of the Tavistock orientation were promoting the autonomous work group as a vehicle toward participative management and work place democracy (Cummings & Molloy, 1977).

The foregoing examples make it clear that there was no consensus among experts concerning Taylor's "one best way" to organize work, and that work innovations are not a recent invention. However, as the following quote indicates, there was not wholesale rejection of Theory X assumptions or practices despite the availability of Theory Y alternatives. Peter Drucker, an advocate of participative decision making,
said in 1981 that his recommendations had fallen on "deaf management ears for the last 35 years". What was it then, that spurred the work innovation "revolution" of recent years? What factors are responsible for the widespread adoption of ideas, theories, and techniques that had previously "fallen on deaf management ears"? The literature suggests that two sets of factors, one economic and one societal, provided the impetus for the work innovation movement.

**Societal Factors**

"A new breed of Americans, born out of the social movements of the sixties and grown to majority proportions in the seventies, holds a set of values and beliefs so markedly different from the traditional outlook that they promise to transform the character of work in America."

- Daniel Yankelovich

Yankelovich's "New Breed" of American worker is a product of the great cultural upheaval of the 1960s and 1970s which was marked by an increased demand for self-expression, self-fulfillment, and personal growth (Yankelovich, 1979). Although the work ethic appears not to have diminished, many aspects of the worker/work place relationship have been brought under question in the wake of these changes, and are reflected by the following findings.

A 1980 Opinion Research Corporation survey found that all
segments of the work force experienced more work
dissatisfaction than in previous surveys, and that a growing
percentage of workers desired achievement, recognition, and
challenge from their jobs (Opinion Research Corporation,
1980). Another survey showed that education level moderated
how workers rated various job factors. The less educated blue
collar portion of the sample gave financial factors the
highest relative ratings, while intrinsic factors such as
interesting work were rated highest by white collar workers
(National Opinion Research Center, 1976). Although not very
great, these differences have implications in view of the
rising educational level of the average worker.

Yankelovich et al. (1977) found that a majority of
surveyed workers want to participate in decisions that affect
their jobs; in fact, 54% said they had a right to take part in
such decisions. Research also indicates changing attitudes
toward authority, with fewer workers, especially the younger,
more educated workers, willing to accept unilateral managerial
authority (Beer, Spector, Lawrence, Mills, & Walton, 1985).
Perhaps the best-known testimonial to the new value
orientation of American workers was the U.S. Department of
Health, Education, and Welfare 1973 study on work place
discontent. A major conclusion of the study is summarized by
the following: "An increasing number of workers want more
autonomy tackling their tasks, greater opportunities for
increasing their skills, rewards that are directly connected to the intrinsic aspects of work, and greater participation in the design of work and the formulation of their tasks" (Work in America, 1973).

These and similar findings (e.g., O'Toole, 1981; Katzell, 1979) make it clear that the attitudes and values of the American work force have undergone significant change, with the traditional economic concerns of workers being supplemented by a rising concern with the psychological quality of work life. Thus, more workers today are demanding more from their jobs - responsibility, autonomy, participation in decision making - in essence, precisely those elements eliminated from work by scientific management. This incongruity between the desires of workers and organizational reality can have negative manifestations for employer as well as employee. In 1970 Delmar Landen, then head of organizational research and development at General Motors, made the following prediction in light of this mounting incongruity: "We are on a collision course. We have built institutions which were very effective in their time, but now there are increased levels of aspirations and different value systems pressing against these institutions" (Jenkins, 1973). Landen's predicted collision became a reality in factories across the country; perhaps the most well known example was the Lordstown, Ohio GM plant where a 1972 strike was
attributed not to economic factors but to QWL issues (Simmons & Mares, 1983). Incidents like this made salient the economic impact of dysfunctional behaviors that can result from ignoring the psychological aspects of work. Following the economic events of the early seventies, the clash between outmoded organizations and new worker values became part of the larger crisis of productivity and competition.

Economic Factors

"Democracy becomes a functional necessity whenever a social system is competing for survival."

-- Warren Bennis

Productivity is measured in terms of the amount of goods or services produced by an average worker in one hour with the materials and methods available to him or her. The annual growth rate in American productivity experienced a serious decline between 1973 and 1980, falling from a high of 3.3% between 1947 and 1965 to minus 0.3% (U.S. Congress, Congressional Budget Office, 1981). A slight improvement of 1.1% during 1981 was offset by the recession of 1982 (Monthly Labor Review, 1982). The seriousness of such productivity figures is intensified when international comparisons are made. Sweden, Germany, and Japan, our principal competitors, experienced average productivity increases of five times the American level during the decade of the seventies (Economic
Report of the President, 1982). Although these countries have also experienced a reduction during the 1980s, their productivity growth rates are still ahead of the U.S. (Work in America Institute, 1982). This productivity decline was accompanied by a decrement in the quality of American products and resultant reputation for shoddy products which caused consumers to seek higher quality from foreign competitors.

The economic model of management has largely ignored the human factor in productivity, viewing labor as primarily a cost in the production process instead of a critical factor in the productive outcome (Work in America Institute, 1982). But the problems cited above have caused a growing segment of American management to reconsider the impact of the human component in the productivity equation, leading to a new view of human resources as potential assets rather than merely a variable cost (Beer et al., 1985). A fuller utilization of the talents, expertise, and creativity of workers is thus viewed increasingly as a viable avenue toward quality and productivity improvements. Such a philosophy not only means a better alignment of managerial practice and prevailing work force values, but has in many cases become an economic imperative.
Work Innovations

The interactive effect of these economic and societal factors has been a work reform movement of considerable magnitude. Systematic attempts to improve work have appeared recently in many guises - quality of work life, humanization of work, and participative management are some of the more popular labels (Walton, 1979). The term work innovation is used here as a broad expression covering all such work improvement efforts. Work innovations, in their many forms, reflect certain assumptions and values about people and work. These include the belief that most people want to be involved in decisions that affect their jobs, that people at all organizational levels can make unique and valuable contributions, and that participation can lead to quality decisions (Beer et al., 1985).

The spectrum of work innovations is broad and the great diversity makes it difficult to classify the different approaches and techniques. However, the Work in America Institute (1982) offers the following parsimonious classification: 1) individual job designs, 2) group job designs, 3) gain-sharing plans, 4) socio-technical systems.

Individual job designs

Included in this category are the more traditional approaches to work improvement. Job rotation and job
enlargement were among the earliest and simplest departures from scientific management practices. Such interventions change only one facet of work - task variety - and are thus not commonly considered to be true work innovations (Work in America Institute, 1982). Job enrichment goes beyond task variety to increase a job’s responsibility, autonomy and decision making prerogative, making it a genuine form of work innovation.

Group job designs

While job enrichment is aimed at the optimal utilization of the skills and talents of individual workers, group job designs are directed at the work group. Included here are consultative and/or decision-making bodies. Consultative groups study and recommend solutions to work-related problems, while management makes the ultimate decisions. Examples are quality circles, employee involvement teams, problem-solving teams, and labor-management committees. Decision-making groups are responsible for the implementation of the solutions they have devised for problems within their jurisdiction. Examples include semiautonomous work groups, where the members of a work unit are responsible for sharing and integrating work tasks. The group is also self-managing in the sense that it assumes such supervisory duties as hiring, training, and scheduling.
Although consultative group approaches have taken many forms, most involve some variation of a common theme - a small group of employees who meet regularly to select, analyze, and solve work-related problems. Many teams receive training in leadership, group dynamics, and problem-solving techniques, thus making them people-building as well as productivity-improvement tools. The different approaches vary in terms of structure, composition, leadership, and jurisdiction, but most are ongoing and voluntary, thus distinguishing them from the more traditional ad hoc task force. A somewhat different consultative mechanism is the labor-management committee. These committees vary widely and are found in both unionized and nonunionized organizations. Entire industries - steel and retail foods, for example - have established some form of the joint labor-management committee, as have such large companies as General Motors, AT&T, and Dana Corporation (Zager & Rosow, 1982).

Gain-sharing plans

Gain-sharing systems have been used for many years and there are many varieties. Some are simply economic incentive plans and are not part of a broader management philosophy of collaboration and participation. Other plans, however, involve employees in decisions that will improve organizational effectiveness and result in an organization-
wide bonus. For example, two integral elements of Scanlon plans are a joint union-management committee structure and a philosophy of participative management (Driscoll, 1979). Variants of the Scanlon plan (e.g., Rucker & Improshare), are similar in that they too attempt to reduce costs by harnessing the efforts and creativity of the work group, and reward success with company-wide bonuses.

**Socio-technical systems**

This is the most extensive work innovation approach and involves the redesign of work around autonomous work groups. Autonomous work groups are work structures where members regulate their behavior around relatively whole tasks. This work design has two primary features which distinguish it from more traditional task structures: the focus of design is interdependent task groupings rather than individual tasks, and task control is located within the work group rather than external to it. The theoretical foundation for this approach is socio-technical systems theory, arising from experiments at the Tavistock Institute of Human Relations in the 1950s (Trist, Higgin, Murray & Pollock, 1963). Modern applications of this system are characterized by job rotation, extensive training, skill-based pay, peer evaluation and broad employee participation (Cummings & Molloy, 1977).

As indicated above, there are many work innovation
options available to organizations seeking QWL and productivity improvements. They represent a variety of theoretical orientations and range in scope from limited interventions to extensive organization restructuring. All are currently being tried in varying degrees in organizations throughout the U.S; among the most popular in recent years is the quality circle.

Definition, Philosophy, and Basic Concepts

The International Association of Quality Circles (IAQC) provides the following definition of a quality circle (IAQC Press, 1982 p. 2):

Quality circles are groups of employees that meet to discuss, identify, and analyze work related problems, to recommend solutions to management, and to implement those solutions, if possible.

Yet, the QC concept encompasses much more than this simple definition suggests. A more complete definition must include the philosophical and theoretical bases of the QC concept. Although the terminology varies, the QC literature stresses a participatory and people-building philosophy in defining the circle concept. For example, Ross and Ross state that "quality circles are based upon the simple concept that nearly all people will take more pride and interest in their work if they are allowed to make meaningful contributions
which influence decisions made about their work" (Ross & Ross 1982, p. 26). According to Barra, the QC concept is based on the premise that the people who do a job every day know more about it than anyone else, and circles are a means to increase quality and productivity by tapping the creative potential of every employee (Barra, 1983). Barra goes on to suggest that circles represent "a people-oriented management style that encourages personal growth and development, self-respect, self-esteem, self-fulfillment, and achievement at work" (Barra 1983, p. xi).

A more comprehensive coverage of the circle concept is offered by Mohr and Mohr (1983), who incorporate all of the above definitions when they define QCs as: 1) a form of participative management, 2) a problem-solving forum, and 3) a human resource development tool. As an approach to participative management, QCs incorporate the philosophy that employees at all organizational levels want to be involved in decisions that affect their jobs and that those closest to a given job are in the best position to evaluate its problems and potential solutions. The QC problem-solving forum, a unique combination of group dynamics theory and statistical quality control theory, serves to operationalize this philosophy by extending problem-solving and decision-making responsibilities down the organizational ladder. These two aspects of their definition provide the vehicle through which
circles serve as a human resource development tool. Participation in organizational decision making and problem solving presents circle members with opportunities for skill acquisition and contributes to personal growth and development by satisfying needs for affiliation, control, and self actualization (Mohr & Mohr, 1983). In summary, circles seem to be viewed as a form of participative management involving employees in decision making and problem solving, and thereby offering individual and organizational benefits.

The definition of quality circles is further clarified by considering some of the basic elements shared by the majority of QC implementations. The following listing of common characteristics is taken from Crocker et al. (1984), Robson (1982), and Thompson (1982).

1. Quality circles are small; they range in size from 4 to 15 members.
2. All members are usually from the same work area.
3. The members usually work under the same supervisor, who is a member of the circle.
4. The supervisor is often the circle leader.
5. Circle membership is completely voluntary.
6. Circles usually meet once a week for one hour on company time.
7. Circles usually meet in special meeting rooms removed from their normal work area.
8. Circle members receive special training in the rules of QC participation, the mechanics of running a meeting and making management presentations, and the techniques of group problem solving.

9. Circle members, not management, choose the problems and projects that they will work on.

10. Circles are assisted by a facilitator who attends all meetings but is not a circle member.

11. A data-based problem-solving approach is emphasized.

12. Usually no financial rewards are provided; most circles rely on intrinsic rewards.

13. Problems are usually not restricted to quality, but also include production, cost, safety, morale, housekeeping, and working conditions.

14. Circles are an ongoing, as opposed to ad hoc, structure. Circles exist as long as the members wish to meet. They can declare themselves inactive; they can reactivate themselves at a later date.

As this listing suggests, circles share many characteristics with other participatory/problem-solving techniques such as suggestion systems, the Scanlon Plan, and zero-defects programs. However, J. M. Juran (1967), in comparing these practices, concluded that the QC concept is extremely innovative in that it breaks with the traditional practices and assumptions implicit in most other techniques.
A major difference is that circles involve workers in a genuine study process in which workers go beyond telling management what they have known all the time. Unlike the techniques mentioned above, QCs start with the assumption that the causes to work problems are not known by either management or the workers and that data-based analysis is needed to determine causes and solutions. Therefore, circle members receive training in the problem-solving strategies required for such a data-based analysis. Furthermore, with other techniques it is not the group that has this responsibility, but either one individual or management. Finally, QCs are unique in their emphasis on the intrinsic rewards of self development and recognition rather than financial rewards (Juran, 1967). Certain of these unique features will be discussed in more detail in later sections.

History and Current Status

Japan

Although QCs originated in Japan, it has been repeatedly emphasized (e.g., Cole, 1979; Ishikawa, 1968) that circles represent the embodiment of many theoretical ideas and practices, many of them originating in the U.S. According to Robert Cole, "QCCs may represent the most innovative process of borrowing and adaptation in the personnel policies of Japanese companies in the postwar period" (Cole 1979, p. 135).
American knowledge from two major sources - statistical quality control and behavioral science theory - provided the basic ingredients, to which Japan added "a simple and most profound twist" (Cole 1979, p. 136). The historical process of borrowing and innovation which resulted in the Japanese quality circle, called the quality control circle (QCC), is traced below.

The history of QCCs begins in post-World War II Japan, where the war had almost completely destroyed Japanese industry and crippled her economy. As part of the Allied Reconstruction plan, efforts were undertaken to train Japanese engineers and scientists in the methods of modern statistical quality control (SQC). SQC, as defined by W. E. Deming, a recognized expert on the subject, is the control of quality through the application of statistical principles and techniques in all stages of production (Deming, 1970). To expedite widespread training in SQC, the Union of Japanese Scientists and Engineers (JUSE), a nonprofit educational organization, was established in 1946. JUSE was instrumental in disseminating Deming's ideas and promoting SQC practices throughout Japanese industry (Ross & Ross, 1982).

The next major figure to contribute to the QCC concept was another American quality control expert, J. M. Juran. In 1954 Juran visited Japan and introduced a new orientation to Deming's original recommendations. Juran emphasized the
managerial aspects of quality control and stressed that quality control must be an integral part of the managerial function throughout the organization, not confined to separate quality control departments (Crocker et al., 1984). It was the Japanese response to this recommendation that differed dramatically from Western practices - the Japanese extended quality control responsibilities to supervisors and the rank-and-file. Quality control shifted from being the prerogative of managers and engineers to being the responsibility of all employees. Thus, quality control mobilized ordinary workers into participation in the operational decision-making process (Crocker et al., 1984; Cole, 1979).

During the late 1950s these ideas were extensively applied, and in 1962 the first QCC was registered with JUSE (Barra, 1983). Kaoru Ishikawa, a Tokyo University professor and leader in the quality control movement, is generally given credit for the formalization of circles. In the JUSE journal QC for the Foremen, 1982, Ishikawa urged supervisors and workers to study quality control activities on the shop floor, using the journal as a guide (Antilla, 1981). In its final form, the Japanese QCC had become a small group of employees working together to identify and solve job-related quality problems while also focusing on the self-development of workers. They are characterized by extensive training programs for foremen, who then transmit their knowledge to
others during QCC meetings. Training emphasizes participative
management techniques and SQC methods such as pareto and

The development of the QCC was part of a broad social
movement toward "all-employee management participation" that
began in the early sixties. This movement incorporated many
features of Western management practice and included, in
addition to QCCs, a variety of participatory mechanisms:
labor-capital conferences, roundtable discussions, group and
individual management-by-objectives, zero-defects, and other
improvement strategies (Cole, 1979). In this supportive
environment QCCs spread rapidly, aided greatly by JUSE. A
1968 survey of 850 major manufacturers indicated the success
of QCCs; of the 72% of firms practicing some form of group
participation, 26% reported the use of QCCs (Japan Federation
of Employer's Associations, 1971). When the survey was
repeated in 1974 this proportion had risen to 39% (Japan
Federation of Employer's Associations, 1975). The absolute
number of circles have increased even more dramatically, from
the 1000 registered with JUSE in 1964 to an estimated 1
million-plus in 1982. Total QCC membership is estimated to
exceed 8 million workers, meaning that approximately one out
of eight Japanese workers is involved in QCC activities (Ross
& Ross, 1982; Crocker et al., 1984).

Circles have expanded in areas other than absolute
numbers. Today, circles exist in nearly every Japanese industry, and though most QCC members are blue-collar workers, they are spreading rapidly among predominantly white-collar industries (Thompson, 1982).

QCCs in Japan have not only proliferated but have also been fruitful (Crocker et al., 1984). Improvements in quality and productivity have been attributed, in part, to the QCC movement. Circles are reported to solve 3-4 problems per year at an average cost savings of $15,000 per year per circle. This translates into annual savings of some $5 billion as a result of circle activity. In 1978, sixteen years after circles began, it was estimated that cumulative savings exceeded $50 billion (Mohr & Mohr, 1983).

United States

Five years after the emergence of the quality control circle in Japan, circles were formally brought to the attention of American management. In 1967 JUSE sent teams of circle representatives to the U.S. to share information and experiences with American companies and members of the American Society for Quality Control. That same year J. M. Juran addressed the American Management Association on the topic of QCs (Gibson, 1982). It was also in 1967 that the first U.S. article on Japanese QCCs was published (Juran, 1967). By 1969 participative problem-solving groups fashioned
after the Japanese QCC had been initiated by a few U.S.
organizations (Hall, 1971; Tuttle, 1971).

In 1974 one of the most widely known implementations of
QCs in the U.S. started at the Lockheed Missiles and Space
Company in Sunnyvale, California. Lockheed's interest in
circles had arisen a year earlier when a small team of
Lockheed managers toured Japanese industrial plants and
observed the QCC process. Favorably impressed by what they
saw, they obtained training materials from JUSE and patterned
their circle program as closely as possible after the Japanese
model (Crocker et al., 1984). The impressive cost savings and
return-on-investment figures realized by Lockheed's early
circles generated some interest in the circle concept among
other U.S. companies; for example, Honeywell, Inc. and Hughes
Aircraft Company began circle programs in 1974.

In spite of the initial success experienced by these
pioneering companies, American interest in circles was limited
during the early and mid-1970s; only about 25 companies were
involved in 1978 (Crocker et al., 1984). However, the
economic and societal conditions of the late 1970s and early
1980's necessitated the search for new ways to increase
quality and productivity and simultaneously enhance the
quality of work life (Gibson, 1982). QCs were increasingly
turned to as one vehicle through which these goals might be
realized. During the early eighties circles experienced an
explosive growth rate throughout American business. A 1982 survey found that 44% of all organizations with more than 500 employees had QCs, as did over 90% of the "Fortune 500" companies (New York Stock Exchange, 1982). In 1983 over 8000 U.S. organizations had implemented circle programs (Dewar, 1984).

Although American circles originated in the production industry, recent years have seen a diffusion of circles to service and health care organizations, public and higher education, and government agencies - virtually all areas of public and private enterprise (e.g., Richards, 1984). Circle membership has also spread beyond blue collar and is now prevalent among clerical, professional and knowledge workers of all types. Clearly, QCs in the United States are popular and widespread, affecting the work life of employees in increasingly diverse settings and occupations.

Quality Circle Structure

A quality circle is both a structure and a process - a group of people and the activities they undertake (Thompson, 1982). The structural components of a circle program will be addressed first, followed by a discussion of the circle process. Figure 1 depicts the QC structure and identifies the basic components comprising the typical circle. These include the steering committee, the coordinator, the facilitator, the
leader and the circle members.

Steering committee

The steering committee is "generally a support, advisory, resource, and policy-making group composed of individuals interested in the use of quality circles" (IAQC Press, 1982, p. 8). The committee's function and primary objective is to provide the leadership to plan, implement, and maintain a successful and permanent QC program (Mohr & Mohr, 1983). The steering committee is normally the first entity to be created once an organization has decided to implement circle activities.

Composition of the steering committee varies across organizations but typically membership is drawn from a cross-section of organizational levels and functional departments (Crocker et al., 1984). Almost all committees include senior management and middle management representatives from major operational departments and personnel, as well as the quality circle facilitator(s). In addition to these many steering committees also include union representatives and first-level supervisors. In some organizations circle leaders and members, often elected, sit on the steering committee (Ross & Ross, 1982). Usually the committee consists of about 6-12 members, depending on the size of the organization (Mohr & Mohr, 1983). Although steering committee composition is
discretionary and varies across organizations and over time, it is recommended that upper-level management be involved to ensure strong support from the top (e.g., IAQC Press, 1982; Dewar, 1984).

Functioning as the circle program's "board of directors", the steering committee sets goals and objectives and is responsible for establishing operational guidelines (Dewar, 1984). The first task is to determine the programs' objectives - the general purpose of the program as well as the specific goals the program is intended to achieve (Mohr & Mohr, 1983). Of course, these are dependent on the unique needs and circumstances of each organization, but general program objectives can be classified as one of two types: either people-building or productivity/quality enhancing. These broad objectives are usually broken down into specific goals by the steering committee; it is very common for a given program to adopt a range of both people-building and productivity enhancing goals. The IAQC has identified a number of goals commonly associated with quality circles:

1. to promote job involvement
2. to inspire more teamwork
3. to increase motivation
4. to create a problem-solving capability in employees
5. to improve communications
6. to enhance effectiveness and productivity
7. to promote personal and leadership development
8. to use the expertise and knowledge of the employees who actually do the work
9. to reduce errors and enhance quality
10. to build an attitude of problem prevention
11. to promote cost reduction.

Once the goals are determined, the steering committee establishes the operational guidelines for attaining the goals through the circle program. Guidelines frequently cover such topics as program implementation, membership and training policies, and operating policies (Mohr & Mohr, 1983). The steering committee is also charged with delineating the scope of circle jurisdiction. Although this may vary, most steering committees identify certain areas as "off-limits" to circles (e.g., pay and benefits, personnel policies, grievances, and interpersonal conflicts are usually excluded from circle consideration). Other issues initially addressed by the steering committee concern program budgeting and selection of the program coordinator and facilitator(s). (See Figure 2 for one company's operational guidelines.)

**Circle coordinator**

As part of the implementation plan, the steering committee will often appoint a coordinator who has the responsibility for administering and overseeing the circle program. The
coordinator is actively involved in program planning and implementation and once circles are established, serves in a maintenance and support capacity. A primary duty of the coordinator is to train facilitators and leaders. Many organizations do not opt to include this position and instead allocate administrative responsibilities to the facilitator(s) (Mohr & Mohr, 1983).

Circle facilitator

The selection of circle facilitator(s) is also made by the steering committee in the early stages of implementation. The number of facilitators needed depends on the number of circles; in small organizations a part-time facilitator is sufficient, while some companies have several full-time facilitators. The typical full-time facilitator is recruited from personnel or quality control departments or is an outside specialist with behavioral science training. The part-time facilitator usually serves four or fewer circles and is often a volunteer from within the organization (Mohr & Mohr, 1983). The facilitator's major role is to serve as a liaison between circles and the rest of the organization (IAQC Press, 1982). For example, the facilitator interfaces with management and technical specialists whose assistance the circle may need in problem solving. Other typical duties include leader training, circle record keeping, program monitoring and
evaluation, and updating the steering committee (Ross & Ross, 1982). The facilitator attends most circle meetings, especially when a circle is new, but does not participate in the problem solving process.

Circle leader

Quality circle leaders provide leadership for the circles and are responsible for the ongoing operation of their respective circles. The primary task is to preside over weekly meetings and guide the circle through the problem-solving process. It is the leader's responsibility to encourage active participation by all circle members. The work group supervisor is usually the initial leader with leadership eventually passing to a nonsupervisory circle member over time (Dewar, 1984). Any circle member can serve as leader once properly trained. Circles often develop their own unique approach to leadership; some elect leaders, some rotate leaders, some have a new leader for each new project.

Circle members

Circle members are usually individuals from the same work group who do similar kinds of work. Members are responsible for attending weekly meetings and for actively participating in the meeting, and for abiding by the group's self-determined code of conduct. Their major duty is to identify, analyze and
solve problems by working through the problem-solving process. Members are also expected to keep nonmembers in their work group informed about circle activities and to solicit their input and feedback.

Quality Circle Process

As mentioned above, the major task of each circle is to identify, analyze, and solve work-related problems. The QC problem-solving process enables the circle to carry out this function. This process has unique characteristics which separate it from processes used by other problem-solving teams or task forces. Fashioned after the Japanese model, the Americanized version has retained the original influence of quality control theory and group dynamics theory. From quality control theory the QC process has borrowed many problem analysis and data collection techniques, while group dynamics theory has contributed brainstorming, the basic technique used to ensure total participation (Ishikawa, 1968). The QC problem-solving framework is shown in Figure 3 along with the techniques frequently employed within the framework. Each step in the process, and its associated techniques, is described below.
Problem identification

The first task is to generate a list of problems within the circle's work area. Although suggestions can be solicited from management, technicians, and/or noncircle workers, brainstorming is the circle technique most frequently employed for problem identification. Brainstorming is a means of getting a large number of ideas from a group in a short time. Brainstorming demands participation and contributions from all group members. Thus, it is a practical application of the concept of synergy: the whole is greater than any of its component parts (Mohr & Mohr, 1983). It maximally utilizes the groups resources in terms of ideas, creativity and expertise. The Quality Circle Institute (1982) outlines the features of brainstorming as it is practiced by QCs: 1) Members take turns contributing ideas, 2) only one idea offered per turn, 3) members may "pass" a turn, 4) brainstorm to saturation (i.e., until all ideas are exhausted), 5) no criticism or evaluation of ideas is permitted, 6) quantity - not quality - is emphasized, 7) cross-fertilization of ideas is encouraged, 8) all ideas are recorded on flip charts. Adherence to these guidelines provides a structural framework which separates brainstorming sessions from gripe sessions (Mohr & Mohr, 1983).
Problem selection

The problem generation phase usually results in the identification of many problems so the next step is to select one problem from the original pool for the group to work on. To facilitate this the circle evaluates the potential problems according to criteria the group feels are important. Commonly used criteria include problem importance, problem urgency, probability of a successful solution, number of people affected, availability of data, and whether the problem is interesting and challenging to the group. Often a matrix checklist is used to evaluate problems against specific criteria, an example of such a checklist is shown in Figure 4 (Dewar, 1984). Once the group has narrowed down the initial problem pool using its evaluation criteria, a vote is taken to determine the final problem.

Problem analysis

Once a problem has been selected the circle must next identify its possible causes. The QC technique used for this purpose is a simplified cause-and-effect diagram, a tool developed by Kaoru Ishikawa for the Japanese quality control circle. This technique prevents the group from making immediate conclusions about the cause of their problem, and requires instead a thorough consideration of all possible causes (Mohr & Mohr, 1983). A cause-and-effect diagram is a
graphic presentation of the relationship of the potential causes of a problem that are categorically classified (Ishikawa, 1967).

There are six steps involved in the construction and analysis of a cause-and-effect diagram (Mohr & Mohr, 1983). First, the effect (the problem) must be clarified and placed in the appropriate box of the diagram. Next, the major cause categories; methods, manpower, material, and machines are placed on the diagram and brainstorming is then used to generate possible causes within each category. Once completed, a typical diagram resembles the skeleton of a fish and is often referred to as a "fishbone diagram". The next step is to identify the most probable cause, and finally, these must be verified through objective data collection. Circles use a variety of data gathering methods, which include observation, experimentation, statistical sampling, surveys, and interviews (Dewar, 1984).

Once data are collected the circle analyzes their findings. This means not only assessing the information but also organizing and displaying the results. Circles use tables, graphs, histograms, control charts and pareto diagrams in both analysis and display; the appropriate choice is determined by the nature of the data (Dewar, 1984). The data collection and analysis tools used by circles are practical tools for verifying the brainstormed causes and aid circle
members in coming to a consensus on what the most probably cause(s) are.

Perhaps the most versatile and frequently used data analysis tool is the pareto diagram. This technique is an application of Pareto's principle of "the vital few and the trivial many," first proposed in the nineteenth century by the Italian economist Vilfredo Pareto. This principle is often referred to as the 80-20 rule: 80% of the problems are caused by 20% of the issues (Crocker et al., 1984). Quality circles put this principle to work when attempting to identify which parameters are causing most of the problems, since it is most beneficial to correct whatever is causing the largest percentage of problems. The pareto diagram visually displays data in order of frequency of occurrence, thus identifying the major causes. This allows the circle to establish priorities and concentrate on those areas producing the most problems. This technique is not only useful to the circle as a data analysis tool, it is also used to graphically display their results during the management presentation (Dewar, 1984).

Generation/evaluation of solutions

The next stage in the problem-solving process is to identify potential solutions to the problem, to evaluate these solutions, and to come to a group consensus concerning the best way to solve the problem. Solutions are generated in
direct response to the findings resulting from data analysis. For example, if pareto analysis has indicated that riveting is the process responsible for the largest percentage of total rejects, then the circle will direct its efforts at solving riveting problems. The brainstorming technique is used to generate potential solutions by circle members, and these ideas are often augmented by suggestions solicited from management, coworkers, technical experts, and/or outside consultants. The need for outside suggestions depends on the expertise of circle members in the specific problem area. Since circles work on problems in their own work area, often they themselves are the "experts", and outside assistance is not needed or used only to corroborate the circle's own ideas.

Once potential solutions are identified, the group evaluates the alternatives against a variety of criteria, including cost and time required for implementation, estimated return-on-investment, completeness of problem resolution, potential negative consequences, reactions, and acceptance by others. The evaluation process may require additional data collection (e.g., obtaining cost estimates of the various alternatives). At this juncture, with sufficient data available, the members are capable of entering into discussions and debates leading to a consensus decision on the best solution for the problem. Upon reaching consensus, the circle formulates an implementation plan detailing how the
circle will carry out its solution (Mohr & Mohr, 1983).

Management presentation

The culmination of the QC process is the management presentation. The management presentation is a formal meeting in which the circle recommends its solution to management and outlines the process which resulted in their recommendation. Essential elements to be included in the presentation are the activities undertaken by the circle in each stage of the problem-solving process: identification, selection, and analysis of the problem; identification and selection of the solution; and the proposed plan for implementing the solution (IAQC Press, 1982). All the data gathered during each of these stages are presented visually, using the data display techniques already mentioned. It is strongly recommended that all circle members participate in the oral presentations (e.g., IAQC Press, 1982; Dewar, 1984).

The most important feature of the management presentation is its reversal of the traditional roles of workers and managers. It is this feature that makes the presentation such a strong source of personal and professional development for circle members, as well providing an excellent opportunity for recognition. The management presentation also introduces a new channel of vertical communication into the organization.

The task of the participants at the presentation is to
"sell" their solution to management by demonstrating its importance and cost-effectiveness. To do this, the circle must be ready to present empirical evidence to support its proposal, as well as a thorough implementation plan to demonstrate its feasibility. It is common for circles to provide management with a written version of the implementation plan that accompanies the oral presentation. (See Figure 5 for the implementation form developed at Iowa State University.) Such a form provides space for management to indicate its acceptance/modification/rejection of the proposal. Management is expected to respond formally to the circle's recommendation in a timely fashion; within two weeks is the recommended time interval (Dewar, 1984). Management is also expected to provide an explanation and rational justification if the circle's proposal is rejected.

Upon approval from management, the circle takes the appropriate actions to implement the solution, which may be completely carried out by the circle or may require assistance from others. This represents the end of the problem-solving cycle and signals the beginning of a new cycle. The entire process is reactivated as the circle identifies new problems for consideration. However, the circle will simultaneously monitor implemented solutions to ensure their continued effectiveness. This may require additional data collection and analysis often in the form of control sheets and cost
Training

The problem-solving process just described involves techniques which are new to most workers and requires the development of new skills before members can effectively participate in quality circle activities. Therefore, adequate training is vital to the success of any circle program (e.g., Ishikawa, 1967; Dewar, 1984). In fact, formal training is an integral part of the QC process and is required at all levels of the QC structure; management, coordinator/facilitator, leaders, and members. A specifically designed course should be given for each of these roles (Thompson, 1982).

Usually, managers and facilitator(s) are the first to receive training, then the facilitator trains the leaders, who then train the members. Initial training of management and facilitator(s) is frequently provided by an external consultant or by off-site training courses. Topics typically covered by such courses are listed in Figure 6. Training packages consisting of audio-visual materials and manuals, available from private consultants or the IAQC, are often purchased to train leaders and members on-site. Some companies, however, develop their own materials for training leaders and members (Mohr & Mohr, 1983).

Although course content and training time vary, most
members receive a minimum of 8 hours training covering QC roles and the steps and techniques of the problem-solving process. A sample course outline for member training is shown in Figure 6. Leaders receive the same training as members, as well as additional training in group dynamics, communications, and participative leadership (Figure 6). Although formal training is important and necessary to the QC process, circle activities are viewed by many as a continuous educational process in which participants train themselves and each other (Thompson, 1982).

Theoretical Rationale

The Quality Circle process draws substantially upon behavioral science theory and research for its rationale (e.g., Marks, 1986; Marks et al., 1986; Mento, 1982). Specifically, the participative decision making (PDM) and motivation literature provide the theoretical basis for the many purported outcomes of QC activities.

Participative decision making literature

By utilizing the resources and contributions of a group rather than a single individual, PDM has certain advantages over more autocratic forms of decision making. Maier (1967) has identified several assets of group decision making that
have been shown to enhance decision quality. These include a greater sum total of knowledge used in the decision process, a greater variety of approaches taken to a problem, and a better comprehension of decisions reached. Vroom (1964) has suggested that participation in decision making can improve productivity by increasing decision quality. Quality circles, as a forum for group problem solving and PDM, are therefore expected to produce better quality decisions and resultant productivity gains.

Besides improving the quality of decisions, participation offers the additional benefit of increased commitment to the decisions made and to their implementation (Maier, 1967; Locke & Schweiger, 1979). The commitment, or sense of ownership, resulting from participation has been shown to help overcome resistance to whatever change might be necessitated by the decision (Miles, 1965; Vroom, 1964) and to increase individuals' intrinsic motivation to carry out the decision (Vroom, 1964; Lawler, 1976). When people participate in decisions they are less likely to resist them because they become "ego-involved" and their self-esteem and feelings of competence are tied to the successful implementation of the decision. In effect, such ego involvement creates expectancies that decision implementation will lead to higher order need satisfaction (Vroom, 1964). Thus, not only are participants less likely to resist changes, they are
intrinsically motivated to carry them out.

It has also been suggested that PDM can influence employee attitudes such as job satisfaction and morale. One explanation of the link between PDM and job satisfaction is that participation provides a mechanism through which employees attain desired values, and that value attainment leads to job satisfaction (Locke & Schweiger, 1979). Quality circles allegedly provide experiences which facilitate the attainment of such values as respect, self-expression, influence, recognition, and independence (e.g., Cole 1980; Juran, 1980). As a vehicle for making desired values attainable, quality circles are thus expected to positively influence the job satisfaction of participants.

Another possible explanation concerning the impact of PDM on job satisfaction has been proposed. Schuler (1980) and Lee and Schuler (1981) have identified role perceptions as intervening mechanisms linking PDM to job satisfaction. They have shown the PDM can positively influence employee role perceptions by reducing role conflict and ambiguity, and thereby increase job satisfaction.

PDM has been found to affect productive outcomes as well as attitudinal variables. PDM has been linked, both directly and indirectly, to increased productivity and reduced costs. PDM has been purported to affect outcomes directly related to productive efficiency, such as increased productivity,
improved decision quality, reduced conflicts, and reduced costs, in a number of studies (e.g., Likert, 1967; Maier, 1973; Strauss, 1963; Tannenbaum, 1962; and Vroom, 1964). A 1985 meta analysis found a strong and consistent positive effect of participation on productivity, as measured by output, withdrawal, and disruptions (Guzzo, Jette, & Katzell, 1985). The activities of identifying relevant problems and attending to their solution in a systematic and ongoing way through formal participative activity methods are suggested as the optimal means for improving employee productivity (Athos & Coffey, 1975). Such participative problem solving provides a direct link between quality circles and productivity improvements.

An indirect link between PDM and productivity has been proposed by Locke and Schweiger (1979). In their review of the PDM literature, they conceptualized two classes of mechanisms through which PDM affects performance; a cognitive mechanism and a motivational mechanism.

The first cognitive factor suggested is that PDM leads to more upward communication and better use of information, which in turn leads to novel or more creative solutions to problems. It then follows that these novel solutions directly impact on productivity (Locke & Schweiger, 1979). The QC process opens a new channel of hierarchical communication through the management presentation. It can therefore be predicted that
QC's will serve as a vehicle through which the cognitive mechanism operates.

A second cognitive mediator linking PDM to productivity was identified by Locke and Schweiger (1979). They suggested that PDM can lead to a better understanding of the job and of decisions by employees. QC's can also promote these outcomes of participation. For example, the QC problem-solving process emphasizes empirical data collection and analysis, which serves as a basis for decision making and fosters thorough understanding of a problem and its causes. Further, management's response to a circle's recommendations must be accompanied by a rationale concerning its acceptance, modification, or rejection.

One of the intervening motivational mechanisms linking PDM to productivity is the notion that PDM leads to increased trust and a sense of control, which is seen as leading directly to less resistance to change (Locke & Schweiger, 1979). It is also proposed that PDM leads to increased ego-involvement and identification with the organization, as well as increased peer pressure and feelings of group support. Together, these lead to more acceptance of decisions, which in turn directly affects productivity. Finally, PDM is expected to result in the setting of higher goals, which lead directly to increased performance (Locke, Staw, Saari, & Latham, 1981). Such motivational mechanisms operating in PDM techniques
provide further theoretical rationale for the purported effects of quality circles on productivity.

In summarizing the PDM literature, Locke and Schweiger (1979) identify the benefits alleged to result from PDM. These fall into two major categories. One is increased morale and job satisfaction and their frequent concomitants of reduced turnover, absenteeism, and conflicts. The second category includes outcomes pertaining directly to productive efficiency, such as higher productivity, better decision quality, better production quality and reduced costs.

Motivation literature

The QC concept is consistent with the work of need theorists (e.g., Maslow, 1970; Herzberg, 1966) which assumes that employees become more motivated if jobs meet their self-esteem and growth needs. QCs are also consistent with McGregor's (1960) Theory Y assumptions about workers and motivation. A major assumption underlying Theory Y is that when jobs provide opportunities for higher order need satisfaction (i.e., when jobs are intrinsically motivating), employees will exercise self-control. The exercise of self-control refers to employee behavior which is functional in terms of the organization's goals, and which therefore contributes to organizational effectiveness.

The literature provides many examples where intrinsically
motivated self-control produces desired behaviors and reduces dysfunctional behaviors (e.g., Tannenbaum, 1968; Argyris, 1964; McGregor, 1960). There is also evidence suggesting that such self-control is most likely to occur when certain conditions exist (Lawler, 1976). These conditions are participation, feedback, and high standards. The first two of these conditions are particularly relevant to the quality circle process, which allows participation in decision making and also provides feedback via data collection and the evaluation of implementations.

Quality circles are also consistent with the job design and job enrichment literature. For example, Hackman and Lawler (1971) proposed four core dimensions believed critical for enhancing the intrinsic motivation of workers: autonomy, task identity, task variety, and feedback. A fifth dimension, task significance, was added to these original dimensions in the job characteristics model proposed by Hackman and Oldham (1976). According to the model, these five dimensions determine critical psychological states, which then influence work attitudes and behaviors. It is claimed that the QC process can improve the motivating potential of jobs via the five core job dimensions. QCs can therefore be expected to impact the outcomes cited in the model: increased intrinsic motivation, higher quality work performance, increased job satisfaction, and reduced absenteeism and turnover.
Another motivation theory relevant to quality circles is Deci's cognitive evaluation theory (Deci, 1975; Deci, 1976). Deci defines intrinsically motivated behaviors as those which take place without apparent external rewards. He posits that intrinsic motivation is associated with the human need for being competent and self-determining. Quality circles are assumed to promote such feelings through participation and the learning and use of new skills. To the extent that QCs accomplish this, circle participation can be expected to raise intrinsic motivation, and thus favorably impact work behaviors. Further, since there are no monetary rewards for circle accomplishments, members' intrinsic motivation would not be undermined by external incentives.

Finally, Locke's goal setting theory of motivation contributes to the rationale for purported QC outcomes. Locke's work has indicated that feedback motivates performance indirectly through its relation to goal setting (Locke, 1978). Especially relevant to the QC process is one of the methods through which goal setting operates. This method involves the development of strategies or action plans for attaining goals (Locke et al., 1981). A cognitive mechanism involving skill development and creative problem solving is hypothesized as the mediator between goal setting and strategy development. Goal setting has been implicated as a key component in successful QC programs (Sikes, Connell, & Donovan, 1980).
Purported quality circle benefits

The participative decision making and motivation literature reviewed above provides a rationale for many of the claims made by QC proponents regarding the benefits of quality circles. The following individual and organizational benefits are among those most commonly cited:

Individual benefits
- Improved quality of work life
- Improved job characteristics
- Need satisfaction (affiliation, esteem, growth)
- Personal and professional development
- Improved job satisfaction

Organizational benefits
- Increased Productivity and Quality
- Cost savings
- Better quality decisions
- Increased commitment to decisions
- Innovative ideas and solutions
- Increased intrinsic motivation
- Increased organizational commitment and job involvement
- Improved communications
- Reduced absenteeism and turnover

Although these purported benefits are consistent with findings from other participation and job design
interventions, they have not been adequately tested in the QC context. The quality circle assessment literature has been dominated by case studies and testimonials, as indicated by the following quote: "...the current state of information regarding the effectiveness of QCs can best be described as a long list of claimed benefits, supported by anecdotal data and isolated cases which do not adequately establish the validity or generality of the benefits claimed" (Wood, Hull, & Azumi, 1983, p. 37). Since this observation was made in 1983, the state of QC assessment literature has remained much the same; only a few controlled studies are available today. These are reviewed below, following a selected review of the voluminous anecdotal literature.

**Assessment literature**

Attempts to measure the benefits of quality circles fall into two categories: changes in employee attitudes and behaviors, and measurable cost savings from circle projects (Gyrna, 1981). Most of the available data fall into the latter category; popular and practitioner journals provide a plethora of reports boasting quantified savings resulting from individual circle projects and total annual savings realized by various circle programs (e.g., Cougar, 1983; Blair & Ramsing, 1983). Impressive return-on-investment figures for QC programs also abound in the literature (e.g., Hutchins,

Although such bottom line results are considered an important outcome of circles, changes in employee attitudes and behaviors are believed by many to be equally important outcomes of circles (Gyrna, 1981), and are the ones of interest in this paper. It is more difficult to assess such changes and therefore there are fewer reports on these variables in the QC assessment literature (Kirby & Holoviak, 1985). As mentioned previously, many of these reports are testimonials and case histories lacking an empirical data base. A selection of these are included in the following review, but the major focus here is on data-based studies. Such studies, classified using Campbell and Stanley's (1963) typology of experimental designs, fall into two design categories: pre-experimental designs (specifically, the one-shot case study, the one-group pretest-posttest, and the static-group comparison) and quasi-experimental designs (specifically, the nonequivalent control group design).

Case studies

A study conducted by Gyrna for the American Management Association (1981) provides anecdotal evidence for quality circles' impact based on the author's extensive interviews in eleven organizations regarding their circle program. He
reported the following effects, observed across the eleven organizations: 1) reduced conflict, 2) enhanced job involvement, 3) enhanced quality consciousness, 4) improved self respect and respect for others, 5) improved personal capabilities. A survey of 24 companies found that circles reportedly resulted in improved organizational communications, increased job satisfaction and commitment of circle members, and quality and productivity improvements (Ross & Ross, 1983).

The Westinghouse case history, provided by the company QC coordinator, offers strong anecdotal support for QCs. Barra states that circles have changed the organizational culture at Westinghouse and helped establish a participatory style of management. He notes that circle members experienced improved job satisfaction, and that their positive attitudes spread to nonmembers as well. QCs are claimed to have contributed to improved lateral and hierarchical communications throughout the organization. Finally, employees purportedly develop more interest and pride in their work and offer less resistance to change as a result of QC participation (Barra, 1983).

A case study of the circle program in the pharmaceutical division of Cutler Laboratories offers additional anecdotal support for QC benefits in the form of improved quality, productivity, and attitudes (Deromedi, 1982). The study specifically stresses the improvement of supervisory attitudes toward subordinates. An anecdotal report of the QC program at
Systems Parking, Inc. indicates improved communications and perceptions of a more trusting atmosphere as a result of circle activities (Dodson, 1982). Better communications and safety improvements were attributed to the circle program in a large public utility company (Marston, 1982). The QC program for municipal employees in the city of Dallas, Texas resulted in increased morale and organizational commitment (Mongaras, 1982). Southwestern Bell claims that circles have enhanced the leadership abilities of employees and have contributed to better organizational communications (Presley, 1982).

Surveyed circle members at a U.S. Air Force base indicated positive perceptions concerning communications, motivation, and job involvement and personal development as a result of circle involvement (Trice, 1982). A survey responded to by participants in a community college circle program indicated that a majority of members experienced improved perceptions of communications, trust, teamwork, and commitment (Moretz, 1983). Both circle members and management were questioned (interviews and surveys) regarding their perceptions of circle benefits at a large hospital; results indicated improvements in communications, perceived quality, and job satisfaction (Buback & Dutkewych, 1982). Polaroid's 70 QCs were given credit for improved communications, better-informed supervisors, and increased productivity after their first two years of operation (Moran & Morey, 1983).
One-group pretest-posttest studies

The Collins Transmission Division of Rockwell International observed changes in division-wide turnover and grievance rates following QC implementation. The turnover rate in the year prior to program start-up was 14%; 18 months later it had fallen to 4.5%. Before circles, grievances were filed at an average rate of 42 per month; this was reduced to 10 per month in the 18 month period after circle implementation (Mohr & Mohr, 1983).

Continental Illinois National Bank and Trust found that two measures of work quality improved during the first two years of its circle program. Quality, as measured by conformance to standards, increased 35%, while customer service increased by 39%. Labor productivity rose 30% during this period, which is contrasted with no change in the year preceding circle implementation (Aubrey & Hirsch, 1983). Two electronics divisions of Honeywell showed increased productivity, as measured by operational costs, in the two year period following the installation of QCs. One division reported a 46% reduction in assembly costs per unit; the other division a 36% reduction. Improved perceptions of cooperation, management response, communications, feedback, participation, effectiveness, and satisfaction were also reported by circle members, as measured by an in-house attitude questionnaire, the Job Reaction Survey (Thompson,
Static-group comparison studies

A study conducted by Crocker et al. 1984 attempted to measure the effects of the UAW-Ford employee involvement program (quality circles) on organizational commitment. The sample consisted of 67 employees at Canadian manufacturing plants; 36 were QC participants and 31 nonmembers served as controls. All subjects responded to a commitment scale measuring three dimensions of organizational commitment: 1) involvement and satisfaction with the organization, 2) willingness to exert effort to achieve organizational goals, 3) willingness to accept organizational values and policies. Mean scores on each of these subscales were compared for QC members and controls. Significant differences (p<.05) in the two groups were obtained on subscales 1 and 3, but the difference on subscale #2 was not significant.

Nate and Wiebe (1986) examined the impact of QCs on employee perceptions of anomie and alienation. Anomie, defined as "literally without name or identity; to be placed in a position of not knowing what one's social character is supposed to be", was measured by the scale developed by Srole (1956). Alienation was defined as a lack of autonomy and control, and was assessed by the Shepard alienation scale (Cummings & Manring, 1977). Of the 145 participants in the
study, 64 were QC members at two Midwest companies and 81 were nonmembers from the same organizations. Responses to each scale were compared for experimental and control subjects; significant differences (p<.10) were obtained only for the anomie variable. In an attempt to replicate these findings, the same scales were administered to QC members (n=61) and nonmembers (n=88) in a Midsouthern organization. Neither the anomie or alienation comparison was significant (p<.10) for this sample (Nate & Wiebe, 1986).

A third study explored the relationship between QC participants and employee's perceptions of the influence they have on their jobs, the characteristics of their jobs, and their overall job satisfaction (Rafaeli, 1985). The sample consisted of 760 employees of a large electronics manufacturer whose QC program had been operating for three years; 455 subjects were QC members while 305 subjects were not. Levels of perceived influence and desired influence were measured by scales developed by the author (alpha = .89 & .86, respectively). Two indices of job satisfaction were employed: overall satisfaction, as measured by Hoppock's (1935) scale, and intentions to remain in current job and organization. Three scales from the job characteristics inventory (Sims, Szilagyi, & Keller, 1976) were used to measure perceptions of autonomy, variety, and interactions with others. A significant difference (p<.05) was observed between QC members
and nonmembers for the perceived influence variable but not for desired influence. No significant difference was obtained for the Hoppock satisfaction scale, but intention to stay was significant at \( p < .10 \). QC members reported significantly (\( P > .01 \)) higher perceptions of task variety than did nonmembers; QC members did not report significantly greater autonomy or more opportunities for interaction.

A study reported by Wiebe and Zahra (1985) compared QC members with nonmembers at two different times following circle implementation; Time 1 was 18 months after circles began and Time 2 was 2 years later. The samples consisted of 311 (Time 1) and 162 (Time 2) employees at two divisions of a large Southcentral manufacturing firm. The outcome variables examined included job satisfaction, measured by the Minnesota Satisfaction Questionnaire (Weiss, Davis, England, & Lofgrist, 1967), perceptions of job characteristics (Hackman & Oldham, 1975), and perceptions of organizational climate, measured by a scale developed by Zahra (1982). The last scale assesses a variety of perceptions; only those for which significant differences were found will be mentioned.

Results for both Time 1 and Time 2 found no significant differences between circle members and controls on any of the job characteristics dimensions. Only one item of the satisfaction scale reached significance (\( p < .1 \)): "the chance to do things for other people". However, the perception
questionnaire (developed by the second author) showed a number of significant results. QC members reported significantly (p<.01) higher perceptions of both hierarchical and lateral communications, found their jobs to be significantly (p<.01) "more interesting and exciting", and felt "more a part of the company", at both Time 1 and Time 2. QC members were also significantly more positive concerning perceived working conditions (p<.01) and perceived quality of work (p<.05). To summarize, QC members' scores were significant at the .05 level or less on 10 of the 14 items on this scale at Time 1, and 7 of 14 at Time 2.

Nonequivalent control group studies

A study by Hunt (1983) monitored six quality circles of the General Dynamics Pomona Division for the six months immediately preceding and following program implementation. Specific measurements taken were number of employee suggestions, turnover, absenteeism, and grievances. Results of the assessment found significant differences in employee suggestion submittal rates and turnover, but no significant differences in absenteeism and grievance rates.

The suggestion rate for circle member employees rose from a preimplementation 13.7% to 74.7% following implementation, a difference reaching significance at p<.05. This contrasts with a decline on the part of control employees from 8.8% to
6.7%. During the same period the attrition rate for QC members dropped from Time 1 to Time 2, and was not matched by similar improvement on the part of controls. During the postimplementation period, QC turnover rate was 8%; the overall attrition rate was 25%. No significant changes were observed for circle members' attendance or grievance rates from Time 1 to Time 2, nor were these rates significantly better for members than for controls.

In the Michoud Division of Martin Marietta, 142 circle members significantly (p<.05) improved their rate of defects per person, from 44% for the six months before joining to 20% for the six months after joining. During the same period, nonmembers improved their defect rate from 40% to 30%; yielding a significant difference between the two groups. Circle members also showed significant gains in attendance; these changes were significantly greater than attendance improvements for control employees (40% and 16% improvement rates, respectively). Circle members also showed a consistently lower rate of OSHA logged accidents, safety incidents, and grievances than nonmembers. No variables were reported on which QCs did not have a positive impact (Tortorich, Thompson, Orfan, Layfield, Dreyfus, & Kelly, 1983).

A two-phase investigation of the QC program at the Tenneco Minerals Company's Soda Ash Operation was carried out
by Seybolt and Johnson (Seybolt & Johnson, 1984; Johnson & Seybolt, 1985). Measures were taken at four times: before circles, 5 months after, 10 months after, and two years after. An in house attitude questionnaire was used to assess attitudes in four categories: organizational climate, job satisfaction, relations at work, and organizational commitment. Results showed that at Time 2, QC members were significantly (p<.05) more favorable than nonmembers on 13 of the 32 areas measured: two items assessing organizational climate, 9 items assessing satisfaction, and both items assessing organizational commitment. At Time 3, members were significantly more favorable on one climate item, eight job satisfaction items, and one commitment item. Circle members remained stable on all but two items showing significant decline from Time 1 to Time 2, while nonmembers' perceptions declined in 13 of the 32 areas. These downward shifts continued for nonmembers between Times 2 and 3 (significant decline in 12 of the 32 areas), while circle members declined significantly in only 4 areas (Seybolt & Johnson, 1984).

Between Times 3 and 4, QC members showed significant improvements in 6 of the 32 areas measured, and members were significantly more positive than nonmembers in 18 of the 32 areas (Johnson & Seybolt, 1985). Those areas in which QCs showed the strongest impact across all comparisons are various facets of satisfaction, interpersonal and intergroup
relations, and communication.

An assessment of the QC program at Iowa State University (Kay & Buch, 1986) found no significant (p<.05) change in absenteeism or performance evaluations for circle members in the year following circle start-up. The study found significant positive change for circle members on one subscale of the Job Descriptive Index (JDI), supervision, but no significant change on the satisfaction with coworkers and the work itself subscales. However, circle members showed significantly greater satisfaction on the work itself dimension than did nonmembers. Members' perceptions of organizational climate, measured by a 25-item scale developed by the Quality Circle Institute (1980), improved significantly after becoming involved in circles. This change was not matched by nonmembers.

The impact of QCs on quality of work life attitudes and on productivity and absenteeism behaviors was investigated in a manufacturing firm by Marks, Mirvis, Hackett, and Grady (1986). QWL attitudes were measured with an in house questionnaire consisting of items derived from the Michigan Organization Assessment Package, and specifically assessed communication and participation opportunities, perceived job characteristics, and growth need satisfaction. Three measures of productivity were used: percentage of hours spent on production, efficiency rate, and overall productivity.
QC participants reported significant increases in suggestions offered from before to after the QC program, but not in any other QWL area. However, nonmembers experienced significant decrements (p < .05) on perceived opportunities for decision making, perceptions of organizational communications, and satisfaction with opportunities for accomplishment and advancement. No such decline was noted for circle members. QC membership was not found to be significantly related to perceived job characteristics and their resulting psychological states of experienced meaningfulness, challenge, and respect. QC members showed significant gains on all three measures of productivity during the two years following circle implementation, while nonmembers showed no significant change (p < .01). Similar results were obtained for absenteeism.

Synthesis and proposed research

Taken as a whole, the controlled studies cited above offer mixed support for purported QC benefits. This contrasts with the overwhelmingly positive picture presented by the anecdotal literature. In general, the literature suggests that QCs can improve work productivity and quality, as measured by a variety of indices (e.g., Marks et al., 1986; Tortorich et al., 1983). The effects of QCs on work behaviors such as absenteeism, turnover, and grievances, is less clear, as indicated by inconsistent findings across studies (e.g.,
Hunt, 1983; Kay & Buch, 1986; Marks et al., 1986). Finally, the available data offer very mixed findings concerning the impact of circles on a variety of attitudinal variables. In general, perceptions of organizational communications is the variable receiving the most consistent support across studies, while a relationship between circle participation and perceived job characteristics and job satisfaction is obtained less often than not.

The studies to date thus offer inconclusive evidence regarding the effects of QC participation on employee attitudes and behaviors. It is clear that more research is needed examining the impact of quality circles on important outcome criteria; the current study is directed at this need. The study will examine the effects of QC participation on four behavioral variables, specifically: productivity, absenteeism, turnover, and grievances. It is hypothesized that participation in a quality circle will have a positive impact on these variables.

Attitudinal criteria are not included in the study due to practical and methodological reasons rather than a belief that they are not important potential outcomes of circle participation. First, many of the participating organizations don't have preimplementation attitudinal data available, and those who did collect such data used a wide variety of attitude assessment instruments, many of them in house.
surveys. This presents a problem in aggregating across organizations. The second problem with attitudinal variables is that they intensify the methodological problems inherent in any study where random assignment is precluded. A central tenet of quality circles is their voluntary nature; the resulting self-selection of subjects into the treatment group makes a matched control group impossible. Although this presents an internal validity threat for any dependent variable, the problem is more serious for attitudinal than for behavioral variables.
METHODS

Setting

The research was conducted at four organizations in central Iowa. All organizations are affiliated with the Central Iowa Chapter of International Association of Quality Circles (IAQC) and have had a circle program in operation for two years or longer. The circle programs at the four organizations share several features typical of most QC implementations: small groups of employees from the same work groups who voluntarily meet one hour a week on company time to solve work-related problems. Circle members in each company receive training in the QC problem-solving process and techniques, as sanctioned by the IAQC (described in an earlier section of this paper). None of the participating organizations offers monetary incentives for circle participation or for cost savings resulting from circle ideas or solutions. Finally, a professional quality circle consultant was employed to implement all four circle programs.

Although quality circle program objectives varied across the organizations, however, all included productivity/quality improvements as well as quality of work life improvements. Enhanced product or service quality, improved productivity, and personnel development were commonly cited objectives.

Participation in the study was solicited from seven organizations in the Central Iowa Chapter of the IAQC.
Initial contact was an on-site meeting between the researcher and each company's QC facilitator. At this meeting the research project was described and a written summary and request for participation was presented (Figure 8). In those cases where the facilitator lacked the authority to approve the project, the facilitator sought approval through the appropriate channels.

Two organizations chose not to participate in the study: one on the grounds of confidentiality, another due to lack of interest in quality circle measurement. A third company was deleted from the sample by the researcher because a zero defects program had been initiated simultaneously with circle start-up. The other four organizations contacted agreed to participate and were included in the study. Each of these is briefly described below.

Organization A is a banking institution with multiple branch offices in a large urban area. The bank's six circles represent approximately 40% of its total staff. Organization B is a large urban hospital employing 2600 people. Nine hospital departments have quality circles. Circle members comprise less than 20% of the hospital's total employment. Organization C, a large state university, has six circles operating in three nonacademic departments. The circle program here is very limited, including but a fraction of university staff employees. Organization D is a rural
manufacturing plant with 1100 employees. Approximately 10% of the company's employees belong to ten circles, each circle representing a different plant department.

Measures

Measures of employee work behaviors were obtained from relevant archival sources within each organization. Absenteeism, grievance, and productivity data were collected for a 24 month period ranging from 12 months prior to QC implementation to 12 months after. This length of measurement provided sufficient time for QC participants to learn and work through the QC process.

Absenteeism

Employee absenteeism records were collected and a rate (number of hours missed annually) was computed for each employee for each 12 month period. Only hours missed due to illness or for personal reasons were used in computing absenteeism rates; absences resulting from vacations, leaves of absence, or industrial injury were not included.

Turnover

The measurement of employee turnover varied by organization, depending on the type of data available. In two organizations (Organizations A, C) individuals - both circle
members and controls - whose employment was terminated in the year following circle implementation were identified and dummy coded. This allowed a comparison of turnover rates between the two groups.

In Organization B, annual company-wide turnover rates (number of employees terminated divided by total number of employees) were computed for the year prior to and the year immediately following circle implementation. This rate was also computed for circle members during the same time period. In Organization D, turnover rates for departments having circles were computed and compared for the year preceding and following circles. A plant-wide turnover rate was also computed, allowing a second comparison. In all organizations, terminations due to any reason - both voluntary and involuntary - were included in computing the turnover rates.

Grievances

Grievance data were collected only for union employees at Organizations C and D. Grievance rates were computed by recording the incidence and frequency of written grievances filed during the 12 months prior to and the 12 months after the circle intervention by each employee. At one organization only 50% of the participating employees are represented by a union and no grievances were filed by circle or noncircle employees during the relevant 24 month period, and this
variable was thus eliminated for this organization.

Productivity

The measurement of productivity at each organization varied according to the nature of the jobs performed at each. In one organization no objective measures of work productivity were available, and annual performance appraisals, rated by departmental supervisors, were used to assess work quality and quantity of each employee. Objective productivity measures were available in two organizations; however, these data were kept for departments rather than for individuals.

In Organization A, departmental productivity was measured as the number of productive hours (i.e., those hours for which output met Industrial Engineering specifications), which, when divided by the number of available hours, yielded a utility index. This utility index was computed quarterly by the organization, and these data were collected for the four quarters preceding and the four quarters after circle initiation.

Several measures of departmental productivity were available from quality assurance and engineering records at Organization D. These included lost time due to accidents, reject rate (percent of line rejects), scrap rate (cost per unit), and efficiency (actual labor expended to a standard). These data were collected for each department with operating
circles, as well as for the entire plant, for each twelve month period.

Subjects
Subjects from each organization consisted of employees from those departments having circles at the time of the study. The experimental group contained those employees who had voluntarily joined a circle and who had been involved in circle activities for at least one year. Employees from the same departments who had chosen not to join a circle comprised the comparison group. In those departments where more than 50% of the employees were circle members, the remainder of the department’s employees served as controls. In the departments where circle membership represented less than 50% of the group, noncircle employees were chosen to match their circle counterparts on the basis of sex and company tenure. In the latter case, control employees were selected in approximately equal numbers to circle members.

Altogether, the total sample consisted of 471 employees; 250 QC members and 221 employees from the same departments not belonging to a quality circle. The breakdown of subjects by organization was as follows: Organization A - 35 QC members and 17 controls, Organization B - 37 QC members and 36 controls, Organization C - 55 QC members and 45 controls, Organization D - 123 QC members and 123 controls.
Data Analysis

Each organization was treated as a separate unit in the initial analysis. The nature of the data available for each dependent variable in each organization determined the type of analysis performed; both inferential and descriptive statistics were employed. A repeated measures analysis of variance was used whenever the data allowed; such was the case with the absenteeism, grievance, and performance appraisal variables.

The turnover and objective productivity measures necessitated a departure from this design due to the nature of the data. The objective measures of productivity, available at two organizations, were kept for departments rather than for individual employees. The types of turnover data varied by organization; in some it was available by individuals and in others only for departments or the entire organization. Regardless of the form of these data, the repeated measures design was inappropriate since no employees, QC or controls, who terminated during the preimplementation period would be included in the sample. Therefore, the results of interest with this variable was a comparison of circle verse noncircle turnover during the postintervention period. Because of these limitations on the turnover and objective productivity measures, descriptive rather than inferential statistics were often more appropriate.
Following the separate analysis of each organization, metaanalytic techniques (Glass et al., 1977) were used to aggregate the findings across all organizations.

Repeated measures ANOVA

As mentioned above, the absenteeism, grievance, and performance appraisal variables were analyzed using a repeated measures analysis of variance (ANOVA). The repeated measure was time: Time 1 was the year preceding QC participation for each employee and Time 2 was the year immediately following the QC intervention. Subjects were nested within work groups (or departments), and within each of these departments, subjects were distinguished both by QC membership and by sex. Further, in one organization, QC and control subjects comprised matched pairs within each work group, and analysis was by pair instead of by person. The design is diagrammed in Table 1.

The model thus consisted of five classification variables: work group (W), person or pair (P), quality circle membership (Q), sex (S), and time (T). This resulted in a model containing a very large number of levels and when the number of values in each level became high, the computational memory requirements exceeded computer capacity. This occurred in three of the four organizations and required that the analyses be performed in stages. In the first stage, the model was
Table 1. Diagrammatic depiction of the repeated measures analysis of variance design
reduced by pooling the error terms and resulted in sum-of-squares values for all sources of variance other than error terms.

In the second stage, the error terms were obtained by running analyses on the repeated measures separately for each level of the between individual (or pair) factors. The sum-of-squares and degrees of freedom for each of these analyses for the sources involving individuals or pairs were pooled. The mean squares derived from these pooled results were the appropriate error terms for mean squares derived from the first stage.

The mean squares obtained in the first stage were quality circle membership, sex, time, and all interactions among them. The mean squares obtained in the second stage were people or pair and the interactions of this source with the repeated measures. The resulting analysis of variance used the Type III sum-of-squares, giving the so called exact test as described in Winer (1962).

Transformations

The within cell distributions were considered in determining the scale of measurement most appropriate for the observed data. These distributions were found to be highly skewed for the absenteeism and grievance data, whereas the performance appraisal data were more normally distributed. A
square root transformation was performed on the absenteeism and grievance data in order to reduce the skewness and to approximate the normality assumption of the analyses.

All analyses of these two variables used the transformed values, while the performance appraisal analyses used original values.

Combining results

As mentioned previously, each organization was treated separately in initial data analysis and meta analytic techniques were later used to aggregate the results across all organizations. The statistical combining of results was done on the absenteeism variable; this was not possible for the turnover variable because the form of these data was not consistent across organizations. Such an analysis was also not feasible for the productivity variables since the measures used to represent productivity were so varied across the organizations. Finally, the grievance variable applied to only one organization. Thus, the treatment of the combined results for the latter three variables was descriptive rather than statistical.

The chi-square statistic was used to allow an over all probability statement regarding the absenteeism variable, where \( x^* = 2 \ln(-\ln P) \) (Winer, 1962, p. 44). The \(-\ln P\) terms for this test were obtained by taking the natural logarithm of the
probability (with the sign changed) from each of the four independent F tests, summing and multiplying by two. Under the hypothesis that the observed probabilities are a random sample from a population of probabilities having a mean of .50, this chi-square statistic has a sampling distribution which is approximated by the chi-square distribution having 2K (K = the number of independent tests) degrees of freedom (Winer, 1962).
RESULTS

Organization A

Absenteeism

None of the absenteeism tests reached significance at the p<.05 level (one-tailed test) for Organization A. The obtained value for the main effect due to quality circles (Q) was $F_{1,83} = 1.80$, and the F value for the main effect of time (T) was .19. The F values for the quality circle by sex (Q*S) and the quality circle by time by sex (Q*T*S) interactions were both zero, since only one male was included in the sample at this organization. The test of primary interest, the quality circle by time interaction (Q*T), yielded an $F_{1,83} = .04$.

Turnover

Individual turnover data for the postimplementation period were available for Organization A. The chi-square statistic would provide an appropriate test for comparing the turnover of circle and noncircle employees during this period. Due to its assumption of independence, the chi-square test should be done by work groups rather than by individuals.

However, these data result in an insufficient number of frequencies per cell when work groups are used, thus precluding the proper use of chi-square in this instance. Therefore, simply looking at the frequencies themselves is a
more appropriate way to describe these data. In the year after quality circles, a total of 10 employees left the organization; only one of these was a QC member.

**Productivity**

As described earlier, a utility index was used to indicate department wide productivity for bank tellers at Organization A. These data were collected for the year before and after quality circles were formed. The four quarterly reports were averaged for the pre and post periods; at Time 1 the department wide index was 79.0, and at Time 2 it had risen to 88.7. (These figures were provided by the company and did not include a variability index.) All but one employee used in computing these figures were QC members.

**Grievances**

Organization A is nonunionized and has no grievance system.

**Organization B**

**Absenteism**

The results of the analysis of variance tests for Organization B are consistent with the absenteeism results for Organization A; none of the F tests reached significance at p<.05. The obtained value for the main effect due to quality
circles (QC) was $F_{1,49} = 1.15$; the main effect for time (T) was $F_{1,49} = 1.21$. F values of 2.91 and .729 were obtained for the quality circle by sex (Q*S) and the quality circles by time (Q*T) interactions, respectively. Finally, the quality circle by time by sex interaction (Q*T*S) was nonsignificant at $F_{1,49} = .99$.

**Turnover**

The data available at Organization B allowed only a postimplementation comparison of QC member turnover with the organization wide turnover rate. One year after quality circles began operating, the organization wide turnover rate (total number employees divided by number terminated) was 17.6%; during the same period this rate was 9.4% for QC members.

**Productivity**

No productivity data, either objective measures or performance appraisals, were available at Organization B.

**Grievances**

This variable did not apply to this nonunionized organization.
Organization C

**Absenteeism**

The absenteeism results for Organization C were less consistent than those of Organizations A and B. Neither the main effect due to quality circles (Q) or the quality circle by time interaction (Q*T) was significant at the p<.05 level, with F values of 3.32 and .65, respectively. The main effect of time (T) was significant at p<.05, with an F_{1,22} = 3.90. The 9.85 F value for the quality circle by sex interaction (Q*S) was significant at the p<.01 level, while the 5.78 F value for the quality circle by time by sex interaction (Q*T*S) reached significance at p<.05.

**Turnover**

Individual turnover data were available at this organization, again making the chi-square statistic appropriate for comparing turnover frequencies between circle and noncircle employees during the postimplementation year. However, as was the case with Organization A, the violation of the independence assumption due to work groups suggests a descriptive rather than a statistical treatment of these data. Twelve employees in the sample terminated during the postimplementation period, of these only five were QC members.
Productivity

Supervisory performance appraisals are used by this service organization to measure employee productivity, and these scores were collected for quality circle and control employees during both the pre and postintervention periods. Two different rating formats are used for these annual performance reviews. One measures work volume or quantity and the other assesses work quality. Both are based on a 10-point scale where 10 is the highest performance level.

Both scales are used to assess exempt employees, while nonexempts are rated only on work quantity. Analysis of the productivity variable therefore involved two separate tests, one for each rating scale. The work quantity analysis was based on all 100 employees in the sample, but only 36 exempt employees contributed data for the work quality analysis.

None of the tests for the work quantity scale reached significance at p<.05. F values (1, 84 degrees of freedom) were 1.11 and .49 for the main effects due to quality circles (Q) and time (T), respectively. An $F_{1.36} = .10$ was obtained for the quality circle by sex interaction (Q*S), while the quality circle by time by sex interaction (Q*T*S) yielded an $F_{1.36} = .11$. The quality circle by time interaction (Q*T) was also nonsignificant, with $F_{1.36} = .41$.

These nonsignificant findings were not repeated for the work quality scale. The test of primary interest, the quality
circle by time (Q*T), was significant at p<.05, with an $F_{1,21} = 5.61$. Neither the main effect due to quality circles (Q) or to time (T) were significant with $F_{1,27} = 1.87$ and $.49$, respectively.

**Grievances**

Although the nonexempt employees here are unionized, there were no grievances filed by the employees in this sample during the pre and postimplementation periods, causing this variable to be excluded for Organization C.

**Organization D**

**Absenteeism**

The results for absenteeism at Organization D are consistent with those from Organizations A and B; no tests reached significance at p<.05. The F value for the main effect due to quality circles (Q) was $F_{1,22} = 3.15$, and for time (T) an $F_{1,22} = 1.66$ was observed. The quality circle by time interaction (Q*T) produced an $F_{1,20} = 2.57$.

**Turnover**

An average yearly turnover rate (total number of employees divided by number terminated) was computed for each QC department and for the entire plant. This rate was computed for the year preceding and the year following QC
implementation. The average turnover rate across QC departments for Time 1 was 5.0%, and at Time 2 this had fallen to .97%, representing a substantial change. The average plant wide turnover rates for these periods were 1.97% and .55%, respectively.

Productivity

Only departmental and plant wide productivity data were available at this organization. Four such measures were collected for the pre and postimplementation periods in those departments having quality circles: reject rate, scrap rate, efficiency rate, and a direct labor utility index. These rates were averaged across QC departments for each 12 month period. The average reject rate for QC departments was 6.9% at Time 1 and had risen to 12.3% at Time 2. The scrap rate rose slightly from .131% to .183%, while the efficiency rate dropped from 102.2% to 98.8%. Finally, the direct labor utility index dropped from 95.2% to 87.4%. QC members represented approximately 20% of the employees in these departments.

These same measurements were collected for the entire plant for purposes of comparison. The plant wide reject rate at Time 2 of 10.1% represented a slight drop from the 10.3% rate recorded at Time 1. The scrap rate rose from .785% to 1.4% and the efficiency rate fell from 101.5% at Time 1 to
99.3% at Time 2. The direct labor utility index also declined, falling from 97.3% to 93.5%.

Grievances

Organization D was the only participant where relevant grievance data were available. The analysis of variance found all one-tailed tests to be significant at the p<.05 level or less. The main effect due to circles (Q) was significant at p<.01, with an obtained $F_{1.88} = 7.75$. The main effect due to time (T) was significant at p<.05, with $F_{1.87} = 5.32$. Finally, the quality circle by time interaction (Q*T), with an $F_{1.86} = 5.23$, was also significant at p<.05.

Combining Results Across Organizations

Absenteism

A chi-square test, where $\chi^2 = 2\sum(-\ln P)$, was used to aggregate the absenteeism findings across all four organizations. Such a test allows an overall probability statement to be made. This statistic was used on the quality circle by time interaction (Q*T), taking the probabilities from each of the four independent $F$ tests to obtain the $-\ln(P)$ terms.

The $-\ln(P)$ values for the four organizations were .13, 1.27, 1.29, and 2.59, respectively. These values were inserted into the formula resulting in $\chi^2_{2.4} = 10.58$. This
value of chi-square is significant at p<.05.

Turnover and productivity

As already mentioned, a statistical meta analysis of these variables was not possible due to a lack of measurement consistency across organizations. Therefore, these data can be handled collectively in description only, and such a discussion will appear in the next section.

Grievances

No combining of results was possible for this variable since data were available at only one organization.
DISCUSSION

Absenteism

Quality circles by time

As indicated by the results of the quality circle by time interaction, no organization in the study experienced attendance improvements as a result of the quality circle intervention. However, when these results were combined across the four organizations, positive change was detected on the part of QC members which was not demonstrated by noncircle employees. It is possible to consider such findings from two opposing perspectives: 1) quality circles did improve attendance but the improvement was only detectable by aggregating across organizations, and 2) quality circles did not affect employees' absenteism.

First, it could be argued that each of the four individual tests did not have enough power to detect any improvements that may have occurred as a result of QC, and that combining results allowed a true picture of this change to be observed. This is certainly possible since work groups (rather than individuals) were used as the unit of analysis, resulting in a loss of experimental power. In support of this argument, all four test results were in the hypothesized direction (i.e., mean scores for QC groups were lower than for control groups). Furthermore, the obtained probabilities were low enough, that when combined, did reach a statistically significant level.
Such an explanation of the results would suggest that circles can, in fact, positively impact employee attendance, as has been claimed by QC proponents (e.g., Gryna, 1981) and reported in numerous case studies (see the Case Studies section of the Literature Review). It would also be consistent with the findings of other researchers investigating the quality circle-absenteeism relationship. For example, Tortorich et al. (1983) reported attendance improvements for QC members which were significantly greater than those of control employees. A similar relationship between quality circles and absenteeism was observed by Marks et al. (1986).

A positive relationship between QC membership and attendance would, furthermore, be consistent with certain interpretations of the PDM literature. As discussed earlier, Locke and Schweiger (1979) have classified the alleged benefits of PDM. One of these is increased morale and job satisfaction, and their frequent concomitants of reduced absenteeism, turnover, and conflicts. Their review of the PDM literature suggests the following linkages:

PDM - Increased Job Satisfaction - Reduced Absenteeism

These linkages have received a great deal of theoretical and empirical support over the years. The evidence supporting the PDM - job satisfaction relationship was discussed at length in the Literature Review section of this paper.
The job satisfaction - absenteeism relationship has also been tested extensively. Although the strength of this relationship varies substantially across studies, a consistent negative relationship has been established (e.g., Muchinsky, 1977). The PDM - job satisfaction - absenteeism sequence thus seems well enough established and will not be disputed here.

However, accepting these relationships does not provide support for the effects of quality circles on absenteeism, since this requires a change in the sequence such that:

QCs - Increased Job Satisfaction - Reduced Absenteeism

In order to so substitute QCs for PDM, it is necessary that circles serve as an effective vehicle for PDM. According to Locke and Schweiger (1979), effective participatory vehicles provide a mechanism through which employees attain desired values, which in turn leads to job satisfaction. Thus, the important question becomes: to what extent do quality circles succeed at providing employees with values which lead to job satisfaction?

As mentioned previously, the QC experience allegedly provides experiences which facilitate the attainment of certain values, such as respect, influence, recognition, and independence (e.g., Cole, 1980; Juran, 1980). Such findings offer support for the QC - job satisfaction linkage. However, the preponderance of empirical studies examining the relationship between quality circles and job satisfaction find
little or no support for this relationship.

For instance, Rafaeli (1985) found no significant differences between QC and noncircle employees' overall job satisfaction, as measured by the Hoppock Satisfaction Scale. Wiebe and Zahra (1985), using the Minnesota Satisfaction Questionnaire, reported significance on only one satisfaction item. Similar results were reported by Kay and Buch (1986), using the Job Descriptive Index; significant positive change for circle members was observed on only one satisfaction subscale. A two phase investigation conducted by Seybolt & Johnson is the only study where the majority of satisfaction items were significantly associated with QC membership (Seybolt & Johnson, 1984; Johnson & Seybolt, 1985). These studies employed a questionnaire developed by the authors rather than a job satisfaction scale.

Such findings do not make a strong case in favor of the QC - job satisfaction relationship, and in the opinion of the author, more research is needed before this relationship can be accepted. It would appear possible that quality circles do not extend enough decision making power to employees to produce the results commonly associated with other PDM techniques. Clearly, circles do not expand participation to the extent of other participatory mechanisms, such as autonomous work groups. QCs only meet for one out of 40 hours weekly, are limited in their range of jurisdiction, and
require that all decisions must ultimately be approved by management, who also has the power to veto them.

When considering the absenteeism results of this study within the context of the motivation literature, observations similar to those above can be made. For example, Hackman and Oldham's Job Characteristics Model states that five core job dimensions determine critical psychological states, which then influence certain work attitudes and behaviors, as illustrated in the following sequence: Improved job characteristics - Psychological States - Improved Attitudes/Behaviors. To the extent that the QC process can improve the motivating potential of jobs via the five core dimensions, circles can be expected to impact the outcomes cited in the model (including absenteeism), such that:

QC - Improved Job Characteristics - Reduced Absenteeism

However, previous research examining the effects of quality circles on job characteristics has not been supportive of this relationship. Rafaeli (1985) found a significant difference between circle and noncircle employees on only one of three job characteristics studied, while another study found no significant differences on any of the five job dimensions (Wiebe & Zahra, 1985). Such results suggest that all outcome variables included in the Job Characteristics Model, such as absenteeism, should not be affected by QC's since circles do not appreciably alter perceived job characteristics. However,
more research exploring the job characteristics - QC relationship is needed before any conclusions are warranted.

In summary, the above discussion seems to favor the second interpretation of the absenteeism results over the first explanation. That is, it seems likely that the tests by individual organizations accurately reflect no impact of quality circles on members' attendance. However, the significant results obtained by aggregating across organizations suggest that at least the relationship between quality circles and absenteeism is in the hypothesized direction. Furthermore, the relatively low power resulting from the experimental unit of analysis leaves open the possibility that circles did improve members' attendance, but that this effect could not be detected.

Finally, there is yet another, perhaps simpler, explanation of the absenteeism findings. It has been theoretically proposed and empirically demonstrated that absenteeism is a very complex outcome variable, affected by nonwork related factors as well as many work related factors. For example, it has been shown that attendance behavior is influenced by factors outside the employees' control, such as family and transportation problems (Steers & Rhodes, 1978). Attendance can also be influenced by a company's absenteeism policy; e.g., Ilgen and Hollenback (1977) found that when sick days are allowed employees will most likely take advantage of
them. Given the many variables shown to affect attendance behavior, perhaps a consistent relationship between absenteeism and a work intervention such as quality circles should not reasonably be expected. This would be true even if the QC intervention resulted in satisfaction improvements, as indicated by the wide range of correlations between job satisfaction and absenteeism reported in the literature.

In concluding the discussion of the quality circles by time results for absenteeism, it seems the only conclusions reached are inconclusive. Two of the three previous studies examining this outcome variable found it to be favorably influenced by quality circles; this study makes it an even 2-2 split. Furthermore, the theoretical rationale necessary for explaining a positive relationship between QCs and attendance (i.e., intervening variables such as PDM, job satisfaction, or job characteristics), is not firmly established in the quality circle literature. More research is needed examining the QC - absenteeism relationship, as well as the effects of circles on these intervening variables, variables which are also of interest in their own right.

Main effects of quality circles and time

The lack of significant results for the main effect due to quality circles at any organization shows that there were no differences between QC verses control employees averaged
across the two measurement periods. This suggests that the baseline measurement was not appreciably different for the two groups. The main effect due to time, averaging absenteeism for the two groups and comparing Time 1 and Time 2, was significant at only one organization. At Organization C, absenteeism for all employees dropped significantly following the QC intervention. With the exception of this organization, the absenteeism rates were fairly steady throughout the entire measurement period.

The interactive effect of sex

The quality circle by sex interaction was significant at one of the four organizations, suggesting that for most of the sample there was not differential representation of males or females in circles. In the one organization where this was not the case, more eligible males than females were involved in QC activities. The results for the quality circles by time by sex interaction matched those for the quality circles by sex interaction; only Organization C showed significant results. This suggests that, with one exception, QCs did not differentially affect males and females.

At Organization C, the significant interaction was caused by a large decrease in absenteeism from Time 1 to Time 2 (with means of 53.53 and 26.57, respectively) on the part of noncircle females. QC females also improved their attendance,
but the gain was much less. The attendance of the males, on the other hand, dropped from Time 1 to Time 2, for both circle and noncircle employees. This differential effect of circles by sex is not readily explained, nor is the fact that noncircle females' attendance improved more than the attendance of female circle members. Since such effects were observed at only one of the four organizations, it appears likely that the results are due to chance.

**Turnover**

As mentioned earlier, the nature of the turnover data did not allow statistical analyses to be performed. However, the results obtained for each organization offer support for the hypothesis that QC membership will positively affect turnover behavior. At all four organizations, circle participants terminated employment less frequently than noncircle employees during the year following QC implementation. When taken as a whole, these differences appear to be substantial.

At one organization, 10 noncircle employees left the organization, as compared to only one circle member. At another, the turnover rate for QC members was almost half the rate observed for comparison employees, while at another over twice as many noncircle employees terminated as did QC participants. And the fourth organization experienced a considerably greater drop in turnover for QC departments than
for noncircle departments. The findings were thus consistent across the organizations and also represented substantial improvements.

These results are also consistent with the two previous studies examining the QC - turnover relationship. Mohr and Mohr (1983) reported significant division wide turnover improvements following QC implementation. A significant reduction in circle members' attrition rates was observed by Hunt (1983) during the postimplementation period; this was not matched by similar improvements on the part of control employees.

The turnover results are also consistent with Rafaeli's (1985) study, which examined the relationship between QC membership and employees' intentions to remain in current job and organization. Rafaeli found the difference between circle and noncircle employees on this variable to be statistically significant. Such findings are relevant here due to the relationship between intentions to stay and turnover. According to Mobley's (1977) model of employee turnover, intention to stay with an organization is an important predictor of actual turnover.

Further support for the turnover results is found in the organizational commitment literature. Turnover is one of several outcome variables shown to correlate with organizational commitment (Steers, 1977). Two studies have
explored the relationship between quality circles and organizational commitment. Crocker et al. (1974) found significant differences between circle participants and nonmembers on two of the three subscales of Porter's Organizational Commitment Inventory (Porter, Lawler, & Hackman, 1974). Similar results were obtained by Seybolt and Johnson; QC members showed significant change on both measures of organizational commitment used in this study (Seybolt & Johnson, 1984; Johnson & Seybolt, 1985). A study by Wiebe and Zahra (1985), showing a significant relationship between QC membership and "identification with the company", is also relevant here since organizational commitment has been defined as "the relative strength of an individual's identification and involvement in a particular organization" (Steers, 1977, p. 46).

Finally, Locke and Schweiger (1979) write that PDM leads to increased ego involvement and identification with the organization (i.e., job involvement and organizational commitment). The literature cited above appears to support the notion that quality circles are a participatory mechanism which can promote the involvement and commitment outcomes associated with effective PDM. This contrasts with the literature discussed in the context of absenteeism, which suggests that perhaps circles are not an effective PDM technique in terms of improving job satisfaction or job
characteristics.

The above discussion argues strongly in favor of the hypothesized link between quality circles and turnover, where commitment, involvement, and intention to stay serve as important intervening variables. The author's interviews and informal discussions with circle members offer additional support for this argument. It was reported that one employee cited quality circles as one reason for not bidding on an in-house job opening; the new job was in a department without QCs. Another employee was forced to relocate within the organization due to job restructuring, and identified the opportunity to continue QC activities as one important criterion in evaluating new job options.

Productivity

The overall results obtained for productivity were quite varied and seem to be a function of both the individual organization and the type of measurement used. Objective measures were used at two organizations, and productivity improvements were experienced at only one. One organization used supervisory ratings on two performance dimensions - work quantity and work quality; improvements were observed on only one dimension. (No productivity measures were available at the fourth organization.) Such mixed findings make it hard to discuss the results as a whole.
Four objective measures of productivity were examined at Organization D: scrap rate, reject rate, efficiency rate, and a direct labor utility index. Decrements on all measures were observed for QC departments, though the decline was slight. (The plant-wide rates for each measure experienced similar decline.) The only index of productivity at Organization A, a utility index, showed substantial gains in the year following quality circles. Finally, circles at Organization C were associated positively with the work quality rating dimension but not with work quantity.

When summarizing these findings, either by organization or by measurement variable, the hypothesis that quality circles increase employee productivity is not supported. Productivity at one organization improved, another experienced decline, and the third showed both improvement and decline. Altogether, five of the seven productivity indices either declined or did not improve following the QC interventions. There are two plausible explanations for these results: 1) quality circles did not contribute to any real productivity gains, and 2) the productivity indices used in the study were not able to detect any productivity improvements that did occur.

Before discussing these explanations, it is instructive to review the literature on which the productivity hypothesis was based. The PDM and motivation literature suggests that productivity can be enhanced through a variety of mechanisms.
It has been suggested (e.g., Vroom, 1964) that participation in decision making can improve productivity by increasing decision quality, and Maier (1967) has identified the group processes which facilitate this quality improvement. PDM is also expected to result in communication improvements and in better understanding of the job and of decisions by employees; both of these are hypothesized mediators linking PDM to productivity (Locke & Schweiger, 1979).

PDM has also been shown to help overcome resistance to change and to lead to greater decision acceptance, providing additional mediators between PDM and productivity. PDM is also expected to result in the setting of higher goals, which leads directly to increased performance (Locke et al., 1981). The motivation literature suggests that when jobs are intrinsically motivating, employees will exhibit behaviors which are functional in terms of the organization's goals, and which therefore contribute to organizational effectiveness. And finally, the increased ego involvement resulting from employee participation is suggested as a motivator resulting indirectly in productivity gains (Locke & Schweiger, 1979).

The literature thus suggests that the outcomes associated with employee participation impact productivity indirectly through such mediators as better communication, understanding, and acceptance. It is possible that these mediators could have been operating in this study, but did not translate into
increased productivity, as measured by the indices available. This seems quite reasonable when the nature of the productivity measures used are considered - scrap rate, labor utilization, supervisory ratings, e.g. - such measures would not necessarily reflect better communication or less resistance to change.

Perhaps different productivity measures would be influenced more by these mediators and would thus allow their effects to be detected. Furthermore, other productivity measures might be more appropriate for assessing the effects of circles on productivity. For example, cost savings resulting from circle projects, benefits accruing from circle ideas, and return on investment figures are aspects of productivity, just as scrap and defect rates are. Quality circles have a well established track record in effecting measures such as these (e.g., Cougar, 1983; Hutchins, 1981; Nelson, 1980). And the circle programs included in this study are also known to have had such an impact. The author received reports of impressive circle accomplishments and estimated and realized cost savings (both "hard" and "soft") from all four organizations.

Thus it seems possible that circles did influence aspects of productivity that could not be detected in this study. Whether this is true or whether the alternative explanation, that QCs had no real productivity impact is true, cannot be
determined from this study. The discussion above suggests that this is at least a plausible explanation. However, this raises the question of why previous studies have reported productivity improvements associated with circles using a variety of measures, including some of those used in this study.

For example, Aubrey and Hirsch (1983) found that three measures of productivity - conformance to standards, customer service, and labor production - rose substantially in the year following circle installation, while Tortorich et al. (1983) reported a significant reduction in defect rates following QCs. Circle members showed significant gains on all three productivity measures used by Marks et al. (1986); percentage of hours spent on production, efficiency rate, and overall productivity. No study was found in the literature reporting no productivity improvements associated with circle activities.

These findings are clearly inconsistent with the present study, an inconsistency which is not readily accounted for. Perhaps the best explanation is that most of the productivity measures used in this study were for departments rather than individuals (only the performance ratings were for individuals). This means that noncircle, as well as circle, employees were represented by the measures, which were thus not "pure" in the sense of reflecting only QC members'
performance. This explanation is supported by the different results obtained at Organizations A and D. At Organization D, circle members comprised only about 20% of the total employment in QC departments, and none of the four productivity measures were improved for these departments. In fact, the productivity of QC departments was very close to the plant wide productivity figures. However, at Organization A, where all but one employee included in the productivity index was a QC member, substantial productivity improvements were observed.

The results obtained for Organization C should be briefly mentioned. Performance appraisals were used as a productivity indicator, and no other study is reported in the literature examining supervisory appraisals as a QC outcome variable. Circle members' ratings on the work quality dimension improved significantly and no such improvement was experienced by control employees. However, no significant differences were obtained for the work quantity dimension. These findings are interesting since, as their name implies, circles focus on quality enhancement.

In conclusion, the results for the productivity measures used in this study did not generally support the hypothesized relationship between quality circles and work productivity. These findings are not consistent with those of previous investigations. More research is needed to help clarify this
inconsistency, and it is recommended that productivity measures used in the future should be carefully chosen, as well as, the unit of analysis (individual verse departmental). As was pointed out, it seems plausible that many productivity gains resulting from quality circles may go undetected by certain productivity measures.

Grievances

The hypothesized relationship between quality circles and grievances was supported, as indicated by the significant quality circle by time interaction observed for Organization D. The predicted relationship was based on the employee influence literature (e.g., Beer et al., 1985) and the findings are consistent with this literature which suggests that there are several avenues of employee influence available within organizations. The traditional avenue has been for employees to unionize and use their resulting "collective voice" to gain greater control over their work lives. The grievance system is a traditional approach to conflict resolution within the unionized organization (Beer et al., 1985).

However, there are other modes of employee influence which give employees input into work decisions and provide less adversarial approaches to conflict resolution. Participatory work innovations, such as quality circles, are one such
employee influence mechanism. It is hoped that these participatory techniques will serve as an avenue of employee influence and reduce the need for more adversarial influence procedures. The presence of both modes of influence in an organization permits a test of this hypothesis.

The significant results obtained for the grievance variable supports this, indicating that employees who gain influence through QCs do, in fact, utilize the grievance procedure less frequently. In fact, the results obtained here further suggest that merely the presence of a participatory influence mechanism can decrease the frequency of filed grievances. This is supported by the significant results obtained for the main effect due to time, indicating that less grievances were filed throughout the organization by noncircle, as well as, circle employees after QCs began operating. Thus it seems that employees do not have to be circle members but can also be influenced by simply having an additional influence mechanism present in the organization.

The results for the main effect due to quality circles are also of interest. This test examined differences between circle members and nonmembers averaged across the two measurement periods. The test was significant and the group indicated that circle members filed more grievances than nonmembers throughout the entire two year period. In fact, of the 78 grievances filed by all subjects in the study, over 2/3
of these were filed by circle members. This suggests that perhaps QCs are most attractive to employees who feel a strong need for influence and will utilize whatever influence vehicles are available to them, be it traditional mechanisms like the grievance process or participatory mechanisms such as quality circles. It was also revealed to the author that there is a strong representation of union activists in quality circles at this organization. It would appear that these active, involved employees have found another viable influence vehicle in the QC program. This has potential benefits for the employees and the organization, since circles are designed to be a nonadversarial influence mechanism. The involvement of union activists is also a good sign for the circle program itself, since union cooperation is frequently cited as an important ingredient in successful circle programs in unionized organizations.

In conclusion, the results reveal strong support for the hypothesized effect of quality circles on grievance rates. The results even indicate a "spill over effect", where the behavior of noncircle employees is also influenced. Such positive effects are consistent with two of the three previous studies investigating the QC grievance relationship. Mohr and Mohr (1983) found a substantial reduction in grievance rates 18 months after circles were implemented, while another study (Tortorich et al., 1983) found that circle members filed fewer
grievances than nonmembers. Only Hunt (1983) found circles to have no effect on employee grievances.
SUMMARY AND CONCLUSIONS

The primary goal of this dissertation was to investigate the effects of quality circles on employee work behaviors. A second goal was to conduct a cross-organizational study which would provide a larger, more reliable data base and would make inter-organizational comparisons possible. Finally, it was intended to provide the organizational participants in the study with valuable feedback concerning their circle programs, information which the circle members, facilitators, and management could use diagnostically and for accountability purposes.

The hypotheses tested in the study were that quality circles would have a positive effect on employees': 1) absenteeism, 2) turnover, 3) productivity, and 4) grievance rates. The research was conducted in two stages: the collection of behavioral data from archival sources on-site at each organization, and the analysis of the data by individual organizations and across organizations. The results of the analyses provided mixed support for the hypothesized effects of quality circles on employee work behaviors.

Each outcome variable was analyzed differently, depending on the form of the available data. Statistical analysis was appropriate for absenteeism, and analyses were done first by individual organizations and these results were later combined for an overall test. The results of the individual tests were
not significant, but combining the results did produce support for the hypothesized effect of circles on absenteeism. Two explanations for these results were discussed and it was concluded that QCs did not appear to have any real impact on absence behavior, although the significant results for the combined data indicate that at least the relationship between quality circles and absenteeism was in the predicted direction.

The turnover and productivity data precluded statistical treatment of these variables. A comparison of circle and noncircle employees' turnover rates during the postimplementation period at all four organizations offered support for the predicted positive impact of circles on employee turnover behavior. The productivity findings, however, did not generally support a positive relationship between quality circles and productivity; results were quite mixed across organizations and productivity measures. It was concluded that such findings could be attributed, at least in part, to the use of departmental rather than individual based measures. Finally, the grievance data, available at only one organization, were subjected to a repeated measures analysis of variance and the significant results supported the hypothesized relationship between quality circles and grievances.

The present research leaves many questions regarding the
impact of quality circles on important work behaviors - questions which can only be addressed by additional research. Several specific recommendations for the direction and nature of future research arise from the current investigation. First, it may not be reasonable to expect a strong or consistent relationship between quality circle membership and absenteeism due to reasons discussed previously. Perhaps a more fruitful avenue of future inquiry would explore the relationship between circles and such intervening variables as job satisfaction and perceived job characteristics. These variables are not only important as mediators but are important outcome variables which have not been adequately tested in the QC context. This is also true of the hypothesized mediators linking quality circles and turnover: organizational commitment and job involvement.

Secondly, it is suggested that the measures used to indicate productivity be carefully selected to permit any so-called "intangible" effects such as better decision quality and less resistance to change to be detected. Also, future studies might lengthen the postimplementation period so that these "intangibles" might have time to be translated into observable improvements on traditional productivity measures. Also, it is suggested that individual rather than group indices provide "purer" measures when testing the effects of quality circles on productivity. Although many organizations
do not maintain individual productivity data, an effort should be made to obtain such data whenever possible. Finally, it seems that performance appraisals are an overlooked outcome variable in the QC literature and the results here indicate that they may be worth future exploration.

Another worthwhile avenue of future investigation is suggested by the grievance results. It would be useful to see if the strong union representation in QCs at the organization in this study also occurs in other unionized organizations. QC composition in terms of union/nonunion membership might also be explored as a covariate in future quality circle studies. Also, the spill-over effect observed for the grievance variable warrants further investigation.

Finally, a call is made for more cross-organizational research on quality circles. Cross-organizational comparisons are especially important in light of the growing evidence that the effects of circles are not consistent across organizations. It is becoming increasingly clear that individual, organizational, and even cultural factors can moderate the relationship between circles and various effectiveness criteria. More research is needed to help establish the contingencies that distinguish effective circle programs. As the QC phenomenon continues to grow, it is imperative that researchers provide an empirical knowledge base to guide practitioners so that circles can provide
maximal individual and organizational benefits. And practitioners must also be encouraged to monitor and measure their own circle programs, for both diagnostic and accountability purposes. A joint measurement effort by academics and practitioners is the best way to ensure the longevity and success of quality circles.
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However important, these milestones represent only a small part of my four years at ISU. I'd like to take this opportunity to formally thank those who "made the difference" for me during those years. To Dr. Layton, my major professor, mentor, and friend - thanks for filling those roles as no one else could have; for your kindness and support; and especially for your nondirective style which meant so much to me. To Dr. Wolins - without who I would never have met my dissertation deadline (nor survived the summer of 1987) - thanks for teaching me more about research and statistics than anyone could have and for generously sharing your time and expertise.

Finally, thanks to Alan, whose sacrifices made it all possible. Without you, there would be no one else to thank.
FIGURES
Source: Lawson and Tubbs, 1980.

Figure 1. The basic components comprising the typical quality circle
Quality Circles Operating Guidelines

I. Operating Policies - Objectives

1. Improve communications through all levels of the Division.
2. Provide employees an opportunity to solve problems, not just identify them.
3. Team building.
4. Improve quality awareness.
5. Improve cost awareness.
6. Get people "more involved" in their work.
7. Link different levels and functions of the organization.
8. Provide professional and personal growth opportunities for participants.

II. Membership Policies - Guidelines

1. All members in each circle should be doing similar work.
2. Each circle should be comprised of 3-15 members with preferred number being 7 plus a leader.
3. If more than 7 people volunteer, the members and alternates will be selected by lottery.
4. If employees at a later date would like to join a circle that is in existence in their work area they should notify their circle leader, and ask to have their name added to the list of alternates.
5. Not only is it voluntary to join a quality circle, it is voluntary to resign. This can be done by notifying the circle leader. If at a later date you want to rejoin the circle, the same procedure as listed in #4 should be followed.

Figure 2. One company's operational guidelines
6. When it is determined by a leader and facilitator that a circle is too small in size, members can be added. Members will not necessarily be added one at a time.

7. During the pilot program, HP employees who are non-circle members may visit circle meetings after checking with the facilitator and leader and obtaining permission.

8. Where circle members come from more than one shift, no more than one supervisor should be involved either as a leader or member. However, it is the facilitator and leader's responsibility to communicate well to other supervisors.

9. An employee under a disciplinary probation is allowed in a circle.

10. A new employee will be allowed to join a circle.

III. Circle Operations

1. Ideally, circles will meet one hour per week on company time.

2. Members will not be paid overtime because the QC is a voluntary activity. The leader must be aware that non-exempt employees may not work any more than 8 hours a day.

3. The collection of labor charges for each employee should go into his or her home location, but against the special quality circle work order.

4. When a circle is first formed, a supervisor should be the leader.

5. Each member/leader shall have one vote.

6. Circles should direct their activities to work-related problems and should not discuss subjects outside their area of responsibility; e.g., other employees, Hewlett-Packard Company wide policies such as benefits and wage administration and hiring/firing and designing new products.

Figure 2 (continued)
7. Circles have the right to accept or reject problems from any source.

8. Circles should identify, analyze and implement solutions to problems as related to their work area. If implementation requires approval of management, the circle should present the problem and proposed solution to management for acceptance.

9. All leaders, facilitators and circle members should receive training in circle techniques.

10. Circles shall monitor effects of solutions for a suitable period of time to verify that the specific problem has been resolved and/or that the solution is viable.

11. During the pilot program, when a leader can not attend a meeting, the leader is responsible for seeing to it that his group has a method of selecting a temporary leader from the group and continuing as if he or she were there.


Figure 2 (continued)
THE PROBLEM-SOLVING PROCESS

<table>
<thead>
<tr>
<th>Identify problems</th>
<th>Brainstorming; Interviewing; Management Comments/Requests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select a problem</td>
<td>Voting; Compare/Contrast With Previously Set Criteria</td>
</tr>
<tr>
<td>Analyze the problem</td>
<td>Obtain data from technical specialists or experts Cause &amp; Effect Analysis; Pareto Graphs; Charts Surveys; Observations</td>
</tr>
<tr>
<td>Generate/evaluate possible solutions</td>
<td>Brainstorming; External Consultants; Experimentation; Demonstrations</td>
</tr>
<tr>
<td>Select solution</td>
<td>Select (If within circle control) Management Criteria Presentation</td>
</tr>
<tr>
<td>Recommend solution</td>
<td>Decide on solution</td>
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<tr>
<td>(If not within circle control)</td>
<td>Follow up and evaluate results</td>
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Figure 3. The QC problem-solving framework (James & Elkins, 1983)
CRITERIA FOR PROBLEM SELECTION

This work sheet is an aid to problem selection for quality circles. It incorporates two criteria:

* Importance. All members must feel that the problem is important. To determine a problem's importance, the members should ask themselves these questions: How much do we care about the problem? How much does it hurt? How badly do we want to solve it?

* Likelihood of Success. Another important consideration is the probability of arriving at a solution. Again, the members should quiz themselves: Can we really do something about the problem? How likely are we to make a difference?

In the left-hand column, list the problems under consideration. Then use the following letters to evaluate them for each of the criteria:

H - High importance or likelihood of success
M - Moderate importance or likelihood of success
L - Low importance or likelihood of success

If you feel that a problem deserves an extremely high or low rating, circle the letter H or L.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Importance</th>
<th>Success</th>
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Figure 4. Matrix checksheet used to evaluate problems against specific criteria (Quality Circle Institute, 1982)
QC Management Presentation Recommendation Summary

Circle

Date

Time

Summary of Problem:__________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Proposed Solution</th>
<th>Implementation Schedule</th>
<th>Responsibility</th>
<th>Approval</th>
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Management Comments: Use Reverse Side

Figure 5. Implementation form used by management to indicate acceptance, modification, or rejection of proposal.
Course Outline for Member Training

Minimum Training Time: 8 hours, either once each week in the regular meeting or in a one-day session.

1. Motivating Opener (e.g., view videotape of "If Japan Can, Why Can't We?)
2. QC roles and structure
3. Brief history of development and spread of QCs
4. Basic meeting skills
5. Basic QC problem-solving process
6. Basic problem-solving techniques; brainstorming, cause-and-effect analysis, pareto analysis, flow charts, histograms, control charts, matrix check sheets, cost-benefit analysis

Course Outline for Leader Training

Minimum Training Time: 16 hours in a two-day session, either on-site (with consultant) or off-site.

1. Same as member training (above)
2. Why some supervisors fear circles
3. How circles can benefit the supervisor
4. Participative versus authoritative leadership
5. Planning, leading, evaluating a QC meeting

Course Outline for Facilitator(s)

Minimum Training Time: 32 hours in a four-day, off-site session.

1. Same as leader training (above)
2. Supporting the circle leader

Figure 6. Sample course outline for member training (Thompson, 1982)
3. Advising the circle  
4. Dealing with management and technical specialists  
5. Directing the preparation of a management presentation  
6. Following up circle proposals  
7. Evaluating circle progress and growth  
8. Evaluating the circle program  

Course Outline for Management Training  

Minimum Training Time: 10 hours  
1. Motivating opener  
2. QC roles and structure  
3. Brief history  
4. Why some managers fear circles  
5. How circles can benefit the organization  
6. How to provide ongoing support  
7. Brief outline of QC problem-solving process and techniques  
8. Proposal follow-up  

Figure 6 (continued)
PROPOSED RESEARCH

The purpose of this research is to assess the impact of Quality Circles on employee work behaviors (productivity, absenteeism, turnover, and grievances). These data will be obtained from organizational records for circle members and comparison employees for a one year period before and after circle implementation. The organizations included in the study are all members of the Central Iowa Chapter of the IAQC.

The importance of measuring the results of quality circles is widely recognized by QC experts and practitioners, as indicated in the attached excerpt. Such research helps organizations diagnose their own circle program, while contributing to a better understanding of the QC concept itself.

The research proposed here offers several benefits to those organizations who choose to participate:

1) Your data will be combined with data from other organizations in the Central Iowa Chapter of IAQC. Comparisons among organizations become possible and the results from this large data base are more reliable.

2) Although your organization must invest some resources in data gathering, the data management will be conducted by the student under the guidance of professional statisticians and psychologists.

3) Forms, questionnaires, and other data gathering procedures will be developed and such devices may be of service in the future. These devices will also be developed by the student with the cooperation of the circle facilitator at your organization. As before, the professional staff at ISU will serve as free consultants.

4) The dissertation will provide a complete report of the findings. A condensed version will be submitted to you, where the unique features of your organization will be described and discussed.

Your participation in the study and your cooperation in the data gathering effort will be greatly appreciated.

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Dr. Paul Muchinsky, Psychologist
Dr. Leroy Wolins, Statistician
Evaluating Quality Circles: The American Application
Robert Wood Frank Hull Koya Azumi
California Management Review, Fall, 1983

The Need to Evaluate QCs

Problems of Faddism - For all the interest in and adoption of QCs in the U.S., it is ironic that this goes on in spite of a lack of reliable evidence that QCs are effective either here or in Japan. To this point there has not been a single published study on the effects of QCs in the U.S. industry in which data was collected before and after the QC intervention and comparisons made with a control group. Such an evaluation is obviously needed.

One reason to urge that the QC concept be thoroughly investigated is to avoid faddism. Often a new idea is adopted unquestionably by a wide variety of managers and subsequently dropped when it fails to live up to expectations. The adoption-disappointment-discontinuation cycle has been observed in many organizations that have adopted MBO (management by objectives) and T-groups. A reasonable body of evaluation research now exists on the contingencies associated with the introduction of MBO and T-groups. This research indicates that the ill fortunes of these techniques were frequently a result of unrealistic expectations, poor implementation, and shifts in the nature of the process over time (e.g., becoming too control oriented in the case of MBO). However, most of the relevant research postdated the peak in U.S. managers' and consultants' interests in MBO and T-groups and therefore was of little use in guiding their adoption or implementation in U.S. companies. In order to avoid the adoption-disappointment-discontinuation cycle that is characteristic of managerial fads, proper evaluation research must be built into QC programs. The greater the time lag between adoption and evaluation, the less of a contribution the evaluation research efforts will make to the effective implementation and management of QC programs in U.S. industry. Managers need to be aware that the data generated by well-designed evaluation programs can be used to modify existing programs as well as for deciding whether or not to adopt a QC program.

Effectiveness Criteria - Before evaluation research can be carried out on QC programs, some consensus must be reached on what criteria should be used. As mentioned earlier, a variety of claims regarding the effects of QCs have been made by various sponsors of programs. These claims are typically based on ex post measures of one or two indicators over a period of less than one year at a single plant and fail to consider contextual factors that may have contributed to the observed effects. As such, they present incomplete and
inaccurate pictures of the effectiveness of QC programs. An example of this is the case of a company which discontinued a pilot program involving four QCs. The program did not lead to any significant cost savings or increases in departmental performance in the first six months, although members of the QCs did report (after the fact) that they felt better about their work. No effort was made to discover if these apparent shifts in morale had any impact on withdrawal behavior in the departments involved, even though data on absenteeism and turnover were available in the company's personnel records.

Although we do not yet have a coherent theory about the effects of QCs, the earlier discussion of why QCs can work does provide a basis for identifying a variety of measurable effects. These potential effects are:

- **Productivity**
  - group/departamental performance rates
  - individual performance rates
  - standardized unit costs
- **Product quality**
  - reject rates
  - client evaluation
- **Worker Morale**
  - satisfaction with supervision
  - satisfaction with coworkers
  - satisfaction with work content
  - satisfaction with organization
  - satisfaction with QCs
- **Cost savings**
  - materials/labor costs
  - machine maintenance costs
  - wastage costs
- **Attendance**
  - absenteeism
  - turnover
  - attendance at QC meetings

Two major problems that must be confronted when evaluating QC programs are the variations in effects over time for the same criterion and the variations in the timing of effects for different criteria. As suggested earlier, the novelty of the new program may lead to an initial spurt in morale and performance, which may then gradually return to pre-intervention levels as the program becomes institutionalized. Similarly, once the QCs have passed the "pebble-in-the-shoe phase," there may be a spurt in cost savings, as the groups work on the problems with the largest possible payoffs. Once these problems are solved, the longer run contribution of the QCs may tend to diminish - even to the point of becoming cost ineffective - as the groups work on problems whose solutions lead to smaller, incremental changes. The survey findings that less than one-third of QC programs are cost effective along the reductions in the numbers of QCs by some early adopters in the U.S. (e.g., Lockheed) may be leading indicators of diminishing rate of return of QC activities. One shot, ex post studies that measure a few indicators will
not capture these trends of effects. Before and after measures of multiple indicators, plus the use of comparison groups not participating in the QC program, are necessary if valid conclusions are to be drawn.

A Concluding Note

QC programs may impact on a variety of criteria, but at this stage there is very little hard evidence for the claimed benefits of QCs. The great attraction of QCs today, as has been the case with earlier managerial fads, is that they provide management with a model program for introducing improvement. But a package of standard tools purchased for a specific job may need substantial modification in order to suit the situation. A more theoretically based understanding of why and where QCs work and why they might fail, when substantiated by research data, can help provide managers with the principles needed for selecting the best aspects of the QC model and adapting them to the situation in their company.

Figure 7. Summary of proposed research and need to evaluate QCs given to organizations included in study