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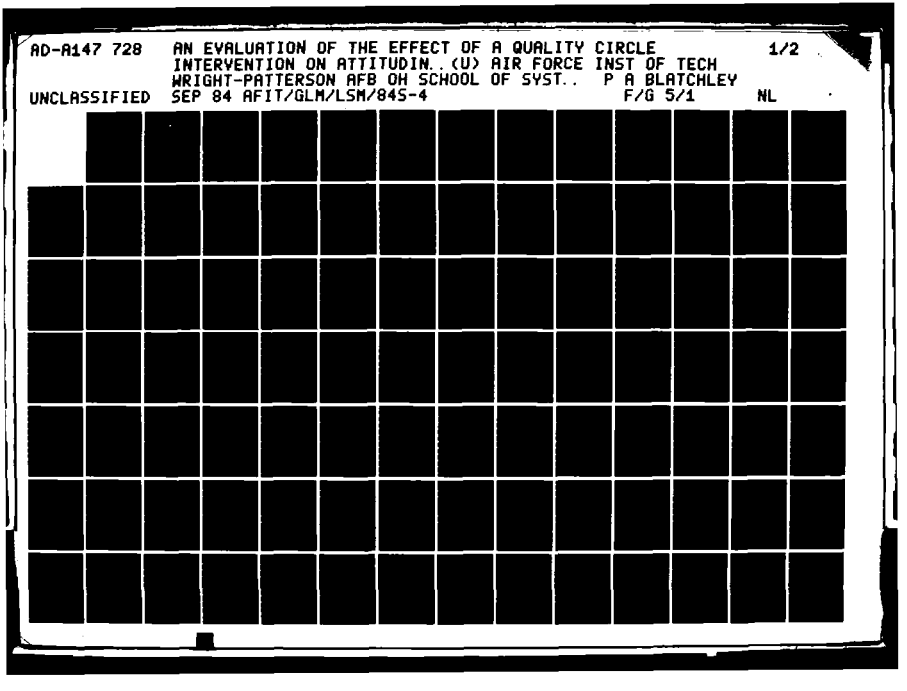

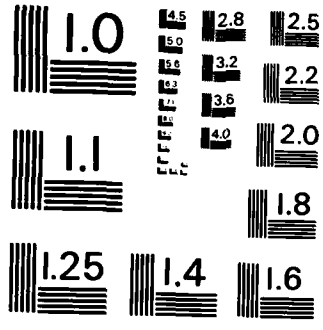

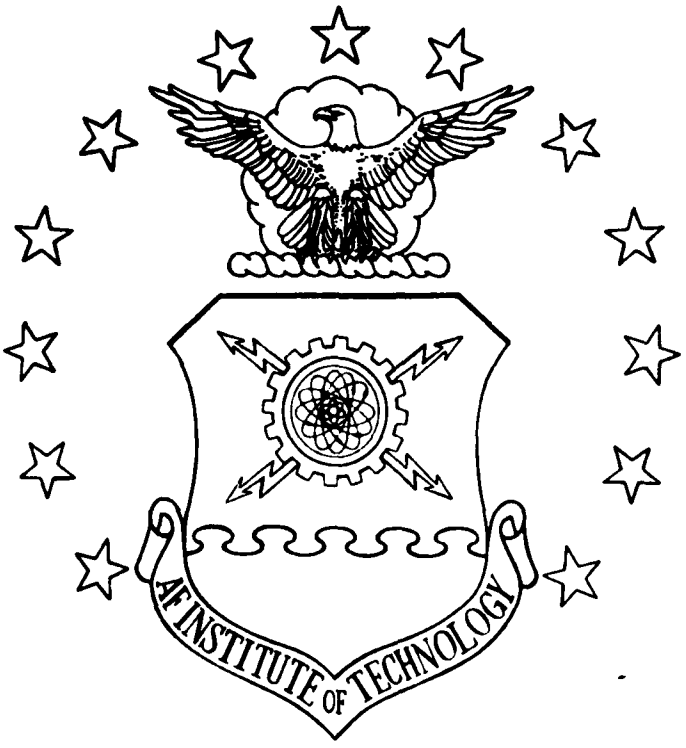

AN EVALUATION OF THE EFFECT OF A QUALITY CIRCLE INTERVENTION ON ATTITUDINAL VARIABLES IN THREE DOD ORGANIZATIONS

THESIS

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Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Peter A. Blatchley, B.S.
Captain, USAF

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Abstract

Quality Circles (QC) have received considerable attention in both DOD and the private sector as a means of enhancing productivity and promoting human resource development. In contrast to the numerous subjective reports attesting to the effectiveness of this organizational intervention, very few empirical studies have been undertaken to objecively protray QC impact on the organization.

This thesis employed a non-equivalent control group design to assess the impact of a QC implementation at an Air Force base in the western U.S. The study sought to measure the effects of the QC intervention on seven attitudinal variables: job satisfaction, self-rated job performance, organizational commitment, job involvement, participation in decision making, group cohesiveness, and intent to remain. Statistical analyses, including mean difference analysis and hierarchical regression analysis, revealed no systematic QC effect on these variables.

This thesis replicated the results of similarly-designed studies which also attempted to measure QC impact via attitudinal variables. It is recommended that DOD continue its efforts to empirically measure QC effectiveness, and that future studies expand their scope beyond the investigation of attitudinal outcomes.

AN EVALUATION OF THE EFFECT OF A QUALITY CIRCLE INTERVENTION ON ATTITUDINAL VARIABLES IN THREE DOD ORGANIZATIONS

I. Introduction

Overview

A Quality Circle (QC) is a problem solving group of five to ten employees within a common work center who, armed with a retinue of QC tools, and headed by their supervisor, seek to identify work problems and develop proposals for their solution (Steel & Shane, 1984). The Department of Defense (DOD) has embraced the QC as the management tool of the 1980s. As many as 1,000 QCs are currently functioning within DOD, and the evidence suggests that their popularity is on the upswing (Steel, Ovalle, & Lloyd, 1982). The concept is viewed as the "state-of-the-art" method for enhancing productivity, product quality, and morale within an organization (Vaughn, 1983).

But has the implementation of QCs actually resulted in improvements in these areas? Or is the QC phenomenon yet another fad in a growing list of miracle management tools that have failed to live up to the often inflated claims of proponents? Unfortunately, the answers to these questions lie beyond the realm of current knowledge.

The vast majority of "evidence" as to the

effectiveness of QCs has been largely subjective, taking the form of anecdotal evidence, impressionistic reports and personal testimonials (Steel, Lloyd, Ovalle, & Hendrix, 1982). In fact, the majority of published reports describing QC implementations is the product of consultants with a clearly vested interest in the apparent success of their projects. As further evidence of the paucity of scientific QC research, consider the fact that of the 56 papers presented at the fourth annual International Association of Quality Circles, not one was a research report. Only recently has a small group of researchers undertaken truly rigorous, empirically based research on the effectiveness of QCs (Steel & Shane, 1984).

Problem Statement

Significant amounts of resources have been invested in the implementation of the more than 1,000 QCs currently functioning within the DOD. Critical evaluation of the effectiveness and outcomes of QC interventions is needed to enable DOD planners to make rational decisions about the future use of this organizational intervention.

This research effort is an attempt to add to the growing body of knowledge about QC effectiveness in the DOD by empirically measuring the effects of QC implementations within three DOD organizations. Specifically, the study will analyze the effect of these QC interventions on the following attitudinal variables: job satisfaction, self-

rated job performance, organizational commitment, job involvement, participation in decision-making, group cohesiveness, and intent to remain.

Hypotheses

This study will evaluate the following hypotheses:

1. The membership of QC work groups experience more job satisfaction than do members of the control group.

2. The membership of QC work groups exhibit superior performance as measured by self-rated job performance in comparison to control group members.

3. The membership of QC work groups exhibit greater organizational commitment than do their counterparts in control groups.

4. The membership of QC work groups exhibit greater job involvement than do the members of the control group.

5. The membership of QC work groups exhibit greater participation in decision making than do members of the control group.

6. The members of QC work groups exhibit greater cohesiveness than do the membership of the control group.

7. The membership of QC work groups demonstrate a greater intent to remain than do members of the control groups.

II. Literature Review

Introduction

This literature review defines Quality Circles (QCs), explains their objectives, and presents a brief overview of their history and evolution. The bulk of the review is devoted to evaluative studies of the effects and outcomes of QC implementations. Several studies are presented, followed by an examination of the barriers to objective, empirical mesurement of QC outcomes. Finally, a brief discussion of each of the attitudinal variables selected for this study is presented, with the objective of capsulizing previous research on each, and relating each to the measurement of QC outcomes.

Definition

Quality Circles, also referred to as quality control circles, are variously defined as a process of human resource development (Ham & McHenry, 1983), an organizational intervention that seeks to increase productivity (Blair, Cohen, & Hurwitz, 1982), a technique for human resource development (Mento, 1982), and a small group of employees organized to "...identify, analyze, and solve production problems" (Ross & Ross, 1982, p.6). In the interest of clarity and continuity, this paper opts for the last definition, and will generally use the term to refer to the actual group of employees.

Cole (1980a) describes this group as "...a relatively autonomous unit composed of a small group of workers (ideally about ten), usually led by a foreman or senior worker and organized in each work unit" (p.24). According to Ross and Ross (1982), the QC meets regularly to "...identify, analyze, and solve product-quality and production problems and to improve general operations" (p.6). QC members are taught simplified techniques of data collection and analysis which are practical, elementary applications of Deming's principles of statistical quality control (Steel, Mento, & Lloyd, 1983).

Objective

The ultimate objective of QCs "...involves furthering the organization's goals in the area of quality control, productivity and employee morale" (Steel & Shane, 1984, p.3). In the area of quality control and productivity, the problems most often analyzed and resolved by QCs entail "...reducing defects, scrap, rework and downtime which are expected to lead to cost reduction as well as increased productivity" (Ross & Ross, 1982, p.6). The other part of the objective, the enhancement of employee morale is facilitated by the self-development of workers. Cole (1980b) describes some expected self-development outcomes: development of leadership abilities, development of skills, identification of potential supervisors, improvement of worker morale and motivation, and stimulation of teamwork

within work groups. Rehg (1978) enumerates three principal objectives that closely parallel Cole's list: development of leadership and managerial ability, increasing worker morale, product quality and problem-solving abilities, and implementation and management of improvement activities at the production level.

Evolution of QCs

The literature consistently cites post World War II Japan as the birthplace of QCs. At the conclusion of hostilities, Japanese industrialists desperately sought a strategy to rebuild their devastated economy. Occupied by the nation they considered the most advanced industrial power on earth, "...it was not surprising that the Japanese were willing and eager to learn from American management techniques" (Cole, 1980a, p. 24), and the U.S. seemed just as willing to teach.

The U.S. occupation force organized a campaign to teach American industrial techniques to Japanese engineers and statisticians. Two of the most noteworthy figures associated with that effort were Drs. W. Edwards Deming and J. M. Juran. Beginning in 1950, Deming presented a series of lectures and seminars in statistical methodology, specifically statistical quality control techniques (Crawford, 1983; Cole, 1980a). Deming challenged the Union of Japanese Scientists and Engineers (JUSE), a catalytic

force in Japan's recovery, to adopt his principles. The industrialists enthusiastically embraced Deming's concepts, and to this day hold him in such high esteem that the Deming Prize has been established to commemorate his contributions in the realm of quality control (Cole, 1980a).

Dr. Juran followed Deming to Japan and in 1954 conducted a series of lectures on quality control. He advocated teaching quality control techniques to middle levels of management, thereby integrating the process throughout the organization (Ross & Ross, 1982). As with Deming, Juran's ideas were readily accepted, but were applied with a distinctly Japanese twist. Workers at all levels began to form study groups with the objective of upgrading quality control practices (Cole, 1980a). "From the combination of statistical techniques and a group orientation toward problem solving came the logical vehicle to carry Japan forward in its growth: quality circles" (Fitzgerald & Murphy, 1982, p.6).

Throughout the 1960s, the QC phenomenon permeated every sector of the Japanese economy. Conservative estimates place the number of functioning circles in Japan today at 500,000, which translates to one of every eight Japanese employees participating in a QC (Cole, 1980b). Others speculate that as many as two million QCs are active, involving five of every six employees in the country (Fitzgerald & Murphy, 1982).

Evaluative Studies of QCs

The QC evaluation literature outlines several objectives in the scientific measurement of QC intervention outcomes. Among the reasons cited for such an analytical orientation toward QC research are: (1) furthering management's acceptance of QCs by validating their potential, (2) discovering the mechanisms through which QCs impact the organization, and (3) accurately accounting for the cost/benefit comparison of a proposed or active QC program (Gibson, 1983; Rehg, 1978; Steel & Shane, 1984; Tortorich, Thompson, Orfan, Layfield, Dreyfus, & Kelley, 1981). But in spite of the potential payoffs associated with accurate, objective evaluations, few attempts have been made to employ scientifically rigorous research techniques. "Beyond the realm of opinion and anecdotal evidence, very little systematic and controlled evaluative research on the effects of QC programs currently exists" (Steel, Ovalle, & Lloyd, 1982, p.40).

Attempts at measuring the effects of QC programs fall into two broad categories of inquiry (Steel & Shane, 1984). The first offers anecdotal appraisals and estimates of cost savings as evidence of QC accomplishments. Steel and Shane (1984) suggest that findings emanating from these studies should be evaluated cautiously, and "...should be weighted into an overall appraisal of QC accomplishments in proportion to their clarity of findings and freedom from

bias" (p.4).

A second category of evaluation is characterized by its attempt to employ scientifically rigorous research designs to introduce a measure of control in the study. Studies within this category fall into three groups (static group, pretest/posttest, and nonequivalent control group designs) and vary as to their level of rigor.

Static group designs. The first group within the controlled research category includes studies which employ a static group design. The study of a naval rework facility by Horn (Steel & Shane, 1984) is typical of this type of inquiry, and is plagued by the limitations of the design. Specifically, the lack of control inherent in the static group design prevents the researcher from attributing any outcome to the quality circle exclusively. Other factors, unidentified and uncontrolled, may have played an equal or more significant part in the impact on the dependent variable (Emory, 1980).

Pretest/posttest designs. A second group of studies employed a pretest-posttest design. Typical of this type of evaluation was the attempt by Hunt (1981) to measure the efficacy of a QC pilot program at General Dynamics.

At General Dynamics, a QC pilot program was introduced into two test facilities during a six-month study to determine the concept's long-range potential (Hunt,

1981). Both organizations conducted similar work, the assembly of electronic components, but differed in most other respects. For instance, two circles were formed in a large division composed of nearly 7,000 unionized workers, while four other QCs were initiated in a significantly smaller division of non-union employees.

Hunt (1981) hypothesized that changes resulting from a QC intervention would occur in the areas of morale and motivation, and performance. She conducted all measurements, with the exception of the attitude survey which was administered at the completion of the pilot project, before and after the QC intervention.

Among the criteria monitored with respect to morale and motivation, Hunt found what she considered significant changes in the number of employee suggestions submitted and in the level of attrition between circle and non-circle employees. Unfortunately, and Hunt (1981) acknowledges this, "...it is difficult, if not impossible, to attribute a specific proportion of the observed results directly to QCs" (p.26).

The inconclusive nature of the data is directly attributable to the study's lack of control. "The pilot program was not a controlled experiment, but a field observation..." (Hunt, 1981, p.26), specifically a pre-experimental design (Campbell & Stanley, 1963). Consequently, many unobserved variables may have impacted

the study's results, and there is no way to identify these and statistically or methodologically control their effects. Steel and Shane (1984) comment on the study's deficiencies: "...these designs provide no reliable control for Hawthorne or novelty effects, a source of bias often linked to programs of this type" (p.56).

Performance criteria employed by Hunt included the completion of specific projects, realization (efficiency), and quality. Hunt measured positive changes in each of these variables. Once again though, the changes cannot be directly attributed to the QC intervention because of the absence of sound controls. In fact, one study (Ham & McHenry, 1983) suggests that the Hawthorne effect is as likely an explanation for the changes in performance as any impact resulting from the QCs.

Hunt (1981) concludes that "...quality circles are an effective means to productivity improvement..." (p.29). The use of a more rigorous research design, specifically one incorporating a control group, may have produced more dependable results.

Nonequivalent control group designs. A third group of evaluative studies attempted to incorporate a nonequivalent control group design to obtain more conclusive results on QCs. The investigation by Tortorich et al. (1981) at Martin Marietta was one of the earliest attempts to employ the nonequivalent control group design in the

measurement of QC effects.

Tortorich et al. (1981) attempted to measure the effectiveness of 40 QCs initiated at the Michaud Division of Martin Marietta. The study spanned a period of three years. The researchers measured both attitudinal and objective criteria to assess the effectiveness of the QCs. Processual data such as the total number of employees trained, and the number of QC presentations to management were used to gauge QC success.

Affective reactions of employees toward their job situations were also measured. A "Team Survey" instrument was devised to measure these attitudes, which the researchers hypothesized are indicators of job performance and organizational climate (Tortorich et al., 1981).

Finally, direct measures of cost-related criteria were used to evaluate "...the impact of QCs on variables which have a profound impact on the overall success of the organization ..." (Tortorich et al., 1981, p.29). These variables included production, defect, attrition, and accident and grievance rates.

Tortorich et al. (1981) used different research designs for each type of criterion. They employed a static group design for the attitudinal variables, and a multiple time series design for the objective criteria (Steel & Shane, 1984). Consequently, for at least the objective criteria, the study introduced a degree of control.

Unfortunately, no such control was achieved for the attitudinal variables. This lack of control, coupled with the study's measurement of overall organizational outcomes instead of more direct effects of QCs, resulted in outcomes which cannot conclusively be attributable to the QC intervention (Ham & McHenry, 1983).

Sander and Atwater (1983) also employed a nonequivalent control group design in their evaluation of QCs in three U.S. Navy organizations. Steel and Shane (1984) called this study "...the most elaborate and well-controlled Quality Circle program evaluation to date ..." (p.7). Sander and Atwater used a variety of procedures to ensure that their conclusions would be empirically based. Among these procedures were: "(1) The administration of a comprehensive questionnaire prior to any circle activities and ten months later, and (2) The collection of organizational data such as sick leave and accidents prior to the implementation of circles and one year later" (Sander & Atwater, 1983, p.194).

In several phases of the study, the efforts to design a controlled experiment are apparent. For instance, during the second phase Sander and Atwater administered an attitudinal questionnaire to both QC members and control group members. Phase three, the collection of organizational indicators, resulted in a base line of data for the year of the QC implementation as well as two years

prior. The fifth phase involved the administration of the attitudinal questionnaire eight months after the initial measurement. Again both control groups and QC groups were surveyed.

Perhaps the most distinguishing feature of Sander and Atwater's study was the use of "...multiple control groups representing increasing degrees of remoteness from the site of the Quality Circle intervention" (Steel & Shane, 1984, p.7).

Another dimension of this study was the use of semi-structured interviews for both QC and control members to determine "...overall reaction to QCs, changes as a result of QCs, problems with QCs, QC training, and reasons for having QCs" (Sander & Atwater, 1983, p.198). The interviews "...tended to paint a more favorable picture of the impact of the QC treatment," conclusions that were not corroborated by the attitudinal and behavioral critera (Steel, Mento, & Ovalle, 1983, p.4). In Sander and Atwater's (1983) words, "...the results concerning the effects of QCs were not supportive of the expectation that QCs would have a positive impact upon a number of job attitudes and perceptions" (p.210). In fact, no significant QC effect was detected on attitudinal or behavioral critera (Steel, Mento, & Ovalle, 1983).

In their review of QC evaluation literature, Steel, Mento, and Lloyd (1983) applaud Sander and Atwater for

having established new standards of empirical rigor in QC evaluative research. But at least one other evaluation effort has surpassed Sander and Atwater's.

Steel, Mento, & Ovalle (1983) have advanced the state of the art of QC evaluation even further. In the most rigorous application of a nonequivalent control group design to date, these researchers evaluated a QC program in a military organization. Data were obtained through pretest and posttest surveys administered in October 1982 and November 1983, respectively. A total of 107 individuals, naturally divided into three QC groups and six control groups, responded to both survey questionnaires.

Through an extensive review of the applicable literature, Steel, Mento, and Ovalle (1983) selected the 20 criterion variables presented in Table I.

A significant improvement in this evaluation over its predecessors was the use of a one-way analysis of covariance to compensate for the lack of treatment group equivalence inherent in the nonequivalent control group design. Another distinguishing characteristic of this study was the examination of several classes of criterion variables. Instead of fixating on attitudinal variables alone, the researchers chose variables representing an array of criterion parameters.

Statistical analyses of the data included *t*-tests, chi square tests, sign tests, and meta-analysis. The

Table I

Twenty Criterion Variables Synthesized
by Steel, Mento, & Ovalle (1983)

1. Job Performance

2. Goal Attributes
   a. Clarity
   b. Difficulty
   c. Realism
   d. Feedback

3. Job Satisfaction

4. Job Involvement

5. Organizational Commitment

6. Group Dynamics
   a. Group Cohesiveness
   b. Communication Climate
   c. Participation in Decision Making

7. "Theory Z" Variables
   a. Perceived Goal Congruence
   b. Supervisory Subtlety
   c. Intra-group Support
   d. Organizational Impersonality
   e. Interpersonal Trust

results produced significant group differences on 7 out of 20 criterion variables at the postmeasure. Additionally, mean differences favored the QC groups in 19 cases.

Steel, Mento, and Ovalle (1983) concluded that "...the QC treatment was reasonably successful in this organization" (p.20). In an interesting corollary finding, the researchers question the reservations expressed by Blair, Cohen, and Hurwitz (1982) concerning the suitability of QC programs for public sector employees.

Barriers to Objective Evaluation

In their review of the evluative research on QC program outcomes, Steel and Shane (1984) decry the paucity of noteworthy investigations: "If the level of scientific rigor found in other field research domains...may be employed as a yardstick, then the Quality Circle evaluation literature exhibits uniformly inferior quality" (pp.3-4). The researchers attribute the lack of scientifically gathered data to "...a set of design constraints to which this type of field research is particularly prone..." (p.4)".

In general, research in the social sciences has been on a lower plane of rigor than that in the physicl sciences. "The social sciences are widely viewed as being relatively backward in scientific development when contrasted with such disciplines as physics and biology" (Ham & McHenry, 1983, p.14). An underlying factor here is the lack of

understanding of the mechanics of social processes (Crawford, 1983). We have yet to synthesize any scientific law explaining the relationships between such abstract concepts as motivation, satisfaction, and productivity (Steel, 1984). Without such a framework of understanding, researchers cannot be sure that they are measuring the critical variables at work in a QC project.

To compound the situation, there is also the issue of the adequacy and propriety of the statistical tools available to gather and analyze the data. It is this second consideration, proper use of the correct statistical tools, which surfaces as a "set of design constraints" in most of the QC evaluative studies. Steel, Ovalle, and Lloyd (1982) identified five "methodological impairments" which acted to confound the results of their evaluation.

The first deficiency mentioned by Steel, Ovalle, and Lloyd (1982) centered on the issue of maturity. Simply stated, researchers are apt to measure the outcome of the QC intervention prematurely. In fact, Steel, Ovalle, and Lloyd (1982) studied three QC groups which were allowed less than a month to develop prior to the administration of the posttest. Certainly any intervention requires considerably more time to impact an organization. Hunt (1981), after a six month study of the QC program at General Dynamics, expressed a similar concern about maturity: "A six-month monitoring phase...is a very short interval in which to

accomplish real and long-lasting organizational changes" (p.113). The literature does not attempt to identify the optimum length of time to allow for process maturity, but Hunt (1981) points out that in some cases several years were required in Japan.

Steel, Ovalle, and Lloyd (1982) identify experimental mortality as the second methodological impairment. "Significant fluctuations in the demographic measures over time indicate that there may have been changes in the composition of treatment groups during the course of the study" (p.44). This phenomenon is unavoidable in field studies. The composition of the work force in any organization fluctuates with hiring, firing, transfers, and retirements. As demonstrated by Steel, Mento, and Ovalle (1983), this phenomenon can be satisfactorily controlled statistically.

The third deficiency involves the concepts of control and equivalency. Ideally both control and treatment groups would be randomly selected to achieve equivalency for statistical comparison (Emory, 1980). Unfortunately, such a luxury of the laboratory is seldom attainable in field investigations. The next best method for achieving equivalency is statistical control, which "...is a less than perfect control for pre-existing differences between groups in a study, as uncontrolled differences may interact with the treatment to produce uninterpretable findings" (Steel,

Ovalle, & Lloyd, 1982, p.44).

Fourth, QC evaluations have tended to fixate on attitudinal measures. That is, researchers have attempted to measure QC outcomes strictly in terms of changes in attitudes among QC subjects. For instance, enhanced employee morale is often investigated as an anticipated QC outcome. Steel, Ovalle, & Lloyd (1982) suggest that a more thorough evaluation of QC implementation would also include behavioral and results criteria.

Steel, Ovalle, & Lloyd (1982) also identify sample size as a methodological deficiency. Small samples are typical in QC research, and the incidence of Type II errors is therefore to be expected (Steel, Ovalle, & Lloyd, 1982). Emory (1980) explains that a Type II statistical error is the probability of accepting as true a null hypothesis that is actually invalid. The smaller our statistical sample, the greater the chance of committing such an error.

Crawford (1983) provides a good summary of the barriers QC researchers face in their attempt to produce objective, empirically-based data:

> The benefits of any behavioral science intervention, such as Quality Circles, are very difficult to determine. The results...do not occur in a vacuum, ...and may be affected by a myriad of events which occur in the organization alongside of the Quality Circle. (p.44)

Attitudinal Variables

The underlying hypothesis of this research is that QC

implementation will change the organization, and the magnitude and direction of that change will be reflected in certain attitudinal variables. The variables chosen as potential barometers of change in this study are: job satisfaction, self-rated job performance, organizational commitment, job involvement, participation in decision making, group cohesiveness and intent to remain. These variables are among those measured by the AFIT Survey of Work Attitudes, the survey instrument used for both the pretest and posttest measures in this research.

The following is a brief review of the literature associated with each of these constructs. It is presented with the intention of providing the reader with a rudimentary understanding of each variable, and to justify their use as gauges of QC impact.

Job Satisfaction. Job satisfaction can be defined as an attitude reflecting positive feelings about the individual's job or some component of the job (Albanese, 1981). However, such a simplistic definition belies the complexity and richness of the construct. It has been the subject of extensive research as an attitudinal construct. Yet, after nearly 5000 studies and articles on the subject, few generalizations about job satisfaction have emerged (Albanese, 1981).

Some of the most reknowned figures in organizational

behavior research have made their mark in the study of job satisfaction. In the late 1920s, when Mayo's famed Hawthorne studies failed to demonstrate the anticipated connection between incentives and productivity, that research shifted to the study of "attitudes". Embodied within that construct was the predecessor of the concept of job satisfaction (Locke, 1976).

Two major content theories have dominated contemporary satisfaction research: Maslow's Hierarchy of Needs, and Herzberg's Motivator-Hygiene theory. Maslow argued that man has five broad categories of needs: physiological needs, safety, social, esteem and self-actualization needs. Maslow's propositions that these needs are arranged in an ascending heirarchy and that the needs at the lower levels must be satisfied before those at the higher levels become effective motivators, have not been supported through subsequent research (Albanese, 1981).

Herzberg theorized that there exist two distinct types of needs: hygiene needs, which can prevent dissatisfaction but cannot satisfy, and motivators, which can actually satisfy. As with Maslow's model, Herzberg's "two-factor" theory has found little support in research studies (Albanese, 1981).

One of the major focuses of job satisfaction research has been the attempt to define a relationship between that concept and job performance. While intuitively appealing,

there is little empirical evidence to suggest that either increased satisfaction enhances performance, or heightened performance boosts satisfaction. However recent studies suggest that satisfaction and performance may co-vary with a third variable, rewards for instance (Albanese, 1981).

Despite the lack of direct correlation between job satisfaction and performance, the concept of satisfaction is important to managers and to organizations. Recently, strong links between job satisfaction and more specific behaviors have been demonstrated. That is, relatively strong positive relationships may exist between the employee's job satisfaction and such factors as lateness, absenteeism, and turnover. Consequently, by improving job satisfaction, corresponding improvements in other factors that can directly impact the effectiveness of the organization may result.

Self-Rated Job Performance. To the extent that QCs are intended to enhance worker productivity and product quality (Steel, Mento, & Ovalle, 1983), a variable measuring the individual worker's job performance is a potential barometer of the impact of the QC intervention. Among the possible raters of an employee's performance are supervisors, peers, subordinates and the job incumbent himself (Beatty & Schneier, 1981). Research has documented the strengths and weaknesses of each type of rating.

The self-appraisal of one's job performance would

intuitively result in an inflated rating. For the most part, research has supported this intuition. In his literature review of self-appraisals of job performance, Thornton (1980) concludes that "...self-appraisals tend to manifest more leniencey, less agreement with other sources, less discriminant validity, and less reliability than ratings by superior and peers" (p.267). In short, individuals perceive their own performance significantly differently than do others. It follows that self-appraisals should be used with care, in either research or in the job context.

Nevertheless, the validity of self-appraisal measures is still controversial. Landy and Farr (1980) concluded that no one particular type of rater appears to be more valid than any other, and that different types of raters have different perspectives on performance which influences the subsequent ratings. Williams and Sieler (1973) found a high degree of correlation (.60) between self- and supervisory appraisals. On the other hand, Holzbach (1978) found them only weakly related, concluding that self-ratings must measure something different than what is measured by superior or peer appraisals.

Organizational Commitment. Organizational commitment, defined as the strength of the individual's identification with and involvement in the orgnization, is

characterized by three factors: (1) a strong belief in and acceptance of the organization's goals and values; (2) a willingness to exert considerable effort on behalf of the organization; and (3) a strong desire to maintain membership in the organization (Porter, Steers, Mowday, & Boulian, 1974). The construct has received attention in recent years as a potential predictor of turnover and individual employee performance, and as an indicator of organizational effectiveness (Steers, 1977).

Studies have generally supported the variable's power to predict turnover. Porter et al. (1974) concluded that organizational commitment outperformed even job satisfaction in differentiating between "stayers" and "leavers". Steers (1977) reached a similar conclusion, having found strong evidence of a link between commitment and the employee's intent to remain with the organization.

Perhaps counter-intuitively, no direct association between commitment and job performance has been demonstrated. Similarly, a study of the relationship between commitment and satisfaction led Porter et al. (1974) to conclude that each construct apparently contributes unique information concerning the individual's relationship with the organization.

Given the link between turnover and commitment, organizational scientists and managers alike will continue to investigate organizational commitment in their pursuit of

ways to increase employee retention. It is in this light that commitment to the organization was selected as a potential indicator of QC effectiveness.

Job Involvement. In its broadest context, job involvement is the degree to which an individual identifies with his work and views it as a central focus of his life (Steel, 1984). In their literature review of the construct, Saleh and Hosek (1976) found four different conceptualizations of job involvement:

> A person is involved (1) when work to him is a central life interest; (2) when he actively participates in his job; (3) when he perceives performance as central to his self-esteem; and (4) when he perceives performance as consistent with his self-concept. (p.215)

In their factorial analysis of these four variations on the concept of job involvement, the researchers determined that a three-factor compilation of these interpretations would best represent the construct. These three factors correspond to the first three mentioned above: central life interest, active participation and performance as central to self-esteem.

Lawler and Hall (1970) reviewed various definitions of job involvement and found a universally accepted definition of the construct elusive. They concluded that job involvement may not be easily distinguishable from what motivation theorists call intrinsic-motivation, the degree to which the person is motivated internally to perform well.

However, the results of their study indicated that it is important to distinguish between job involvement, intrinsic-motivation, and satisfaction as well. Job involvement "...seems to be a distinctive job attitude, one that should be thought of as conceptually and empirically separate from satisfaction attitudes and from intrinsic-motivation attitudes" (Lawler & Hall, 1970, p.310).

Lawler and Hall (1970) separated intrinsic-motivation and satisfaction connotations from the job involvement construct to arrive at the following definition: job involvement is "...the degree to which the job situation is central to the person and his identity" (p.311). They hypothesized that job involvement may be more a function of the individual than of the job itself, and that "...the more the job is seen to allow the holder to influence what goes on, to be creative, and to use his skills and abilities, the more involved he will be in the job" (p.310).

In conclusion, job involvement can be viewed as "...the degree to which a person identifies with his job, actively participates in it, and considers his performance important to his self worth" (Saleh & Hosek, 1976, p.223). Therefore, to the extent that QCs are theorized to enrich the job through enhanced task identity and significance, job involvement qualifies as a potential register of that aspect of the QC intervention.

Participation in Decision Making. Employee partici-

pation in decision making (PDM) is fundamental to the QC concept. In its own right, PDM has long attracted the attention of behavioral scientists as a construct "...loaded with ideological and moral connotations" (Locke & Schweiger, 1979, p.266). The definitions of this construct are as diverse as the researchers who study it. In their literature review of PDM, Locke and Schweiger (1979) define the concept as "joint decision making." The researchers are quick to add that the definition does not denote an equal sharing of decision making responsibilities, but only some degree of sharing. Nor does it specify the content of what is shared.

As to the degree of participation, PDM can vary along a continuum anchored by "no participation" and "full participation", with various shades of joint decision making in between. Similarly, the content of the shared decision making can range from "routine personnel functions" to the work itself and work conditions, to company policies. In short, PDM is a multi-dimensional construct with different meanings to different researchers.

Locke and Schweiger (1979) write that the purported benefits of PDM fall into two major categories: morale and job satisfaction, and productive efficiency. Their extensive review of the many PDM studies led to their conclusion that, with respect to morale and job satisfaction, PDM was superior to a more directive style of

leadership. PDM fared less well with respect to productive efficiency. In fact, the researchers detected no trend in favor of participative leadership.

Locke and Schweiger (1979) suggest a contingency view for the study of PDM. Vroom (1976) has proposed one such contingency view in his Vroom-Yetton normative model, which deals with the "...extent to which the leader shares his decision-making power with his subordinates" (p.18). At the heart of the model is a "decision process flowchart" that enables the leader to assess certain situational variables and arrive at a "feasible set" of alternative decision processes appropriate to his particular problem. Vroom (1976) lends support to Locke and Schweiger's advocacy of a contingency approach to PDM: "I do not see any form of leader behavior as optimal for all situations" (p.18).

Group Cohesiveness. Definitions of cohesiveness are many and varied, but generally it is considered a group characteristic "...in which the forces on the members to remain in the group are greater than the forces acting on them to leave" (Albanese, 1981, p.366). Researchers generally recognize two major categories of these cohesive forces: those contributing to intermember attraction, and those positively influencing the achievement of group members' personal goals (Albanese, 1981).

Among the phenomena contributing to intermember

attraction, the category most researchers have focused on, the distance between employees has emerged as the single most significant factor in determining the rate of interaction (Lott & Lott, 1965). Other factors include common work goals, fulfillment of expectations, perception of a common external threat, homogeneity of status, degree of influence, certain personality characteristics, similarity of background, attitudes, and shared success or failure.

There is a two-way relationship between cohesiveness and performance. On the one hand, successful accomplishment of group tasks can enhance group cohesiveness. Alternatively, cohesiveness can exert either a positive or negative effect on performance. The deciding factor in the latter relationship appears to be the degree of congruency between the nature of the cohesive force and group goals (Albanese, 1981).

It is theorized then, that the QC intervention will result in greater group cohesiveness since the distance between group members may be reduced, work goals may become more widely shared, group members' expectations may be better fulfilled, and the QC program may allow the group to improve its performance and share in the greater success. In short, the QC intervention brings with it the potential for an increase in group cohesiveness.

Intent to Remain. In developing their Process Model

of Attitudes, Aizen and Fishbein (1980) theorized that the best predictor of behavior is a behavioral intention, not an attitude. Research in the area of employee turnover has generally supported their assertion. The research has focused primarily on four variables: job satisfaction, job involvement, organizational commitment, and intent to remain. Kraut (1975) concluded from his study of turnover and its predictors that a direct measure of the employee's intent to remain with an organization is the best predictor of his subsequent turnover. As a predictor, intent to remain appears most effecive in the short-term (up to 18 months after the measure), but is still significantly predictive for up to five years.

Kraut (1975) employed a single measure of intent in his research questionnaire: "If you have your own way, will you be working for (this company) 5 years from now?" The five possible responses ranged from "certainly" to "certainly not". Kraut (1975) concluded that a multi-item measure might result in even higher levels of predictive power.

Researchers have investigated other variables for their ability to foreshadow turnover. Mowday, Stone, and Porter (1979) searched unsuccessfully for relationships between turnover and personality characteristics. The constructs "need for achievement" and "need for autonomy" proved no more reliable in their predictive ability.

Inasmuch as turnover is of practical as well as theoretical value to researchers and managers, analysis of the intent to remain variable, its best predictor, should prove fertile ground in the study of a QC intervention.

Summary

In the country of their origin, QCs have been enthusiasticlly embraced. It is conceivable that the U.S. may someday adopt the QC intervention with as much fervor as the Japanese, but preferably not until the verdict is in on the effectiveness of the QC intervention. Only recently have researchers begun to employ sufficiently rigorous evaluative methods in their study of QCs. Consequently, the number of empirically based evaluations is too small to support any conclusion as to the effectiveness of QCs. Many more high quality studies are needed before any such overall conclusion may be made.

A review of the literature dealing with the seven attitudinal variables selected for this study supports their use as potential barometers of QC impact on the organization.

III. Method

Sample

Three organizations, collocated at an Air Force Base in the western U.S., were the focus of the study. These organizations were a Civil Engineering Squadron, an operational ICBM squadron, and a Training squadron. Each organization was composed of a number of work groups, each of which were provided the opportunity to participate in the QC implementation. A total of 119 work centers and nearly 700 individuals were involved in the study. The average respondent to the pretest survey questionnaire was an enlisted male, age 26 to 30, with at least a high school education and some additional college work.

Measures

The vehicle employed to gather both pre- and posttest data is a survey questionnaire developed by AFIT staff. The "AFIT Survey of Work Attitudes" is a compilation of several well known measurement scales as well as some that were developed in-house. Of the 137 items in the questionnaire, 7 are designed to gather demographic information. The remaining 130 items are intended to measure attitudinal and behavioral variables. Responses to the items (other than demographic data) are recorded on five- or seven-point Likert-type scales.

Appendices C through I contain the questionnaire

items associated with the variables measured in this study. Only a portion of the survey's items were used, since the instrument measures other attitudinal variables not included in this study.

Reliability. In order to assess the survey instrument's internal consistency reliability, Cronbach's coefficient alpha was calculated for each of the seven variables in the study. Only the pretest measure from each of the 223 matched cases was used in this estimation of reliability. The reliability coefficients are presented as Table II. In each case, the coefficients compare favorably with reliability figures cited in previous research on each construct.

The discussion that follows focuses on the seven variables involved in this QC evaluation, and how the survey instrument purports to measure them.

Demographic Characteristics. Part I of the survey, entitled "Background Information", is used to collect the following demographic information: age, education, sex, time in the organization, span of supervision, status (i.e. officer, enlisted, GS, etc.), and paygrade. This information was used in the study for two purposes. First, this data enabled the researcher to detect potentially confounding demographic differences between control and treatment groups. Also, the information was used to

Table II

Internal Consistency Reliability
for All Attitudinal Variables

Variable	# of Items	N	Cronbach's Alpha
Organizational Commitment	15	216	.88
Self-rated Jqb Performance	5	219	.93
Job Satisfaction	5	221	.79
Job Involvement	5	221	.92
PDM	5	220	.87
Cohesiveness	3	222	.76

indicate changes in group composition over time. The detection of these differences is critical to the process of filtering out confounding processes, that is, influences other than the QC intervention. The survey's demographic items are presented in Appendix B.

Job Satisfaction. The survey contains five items designed to measure job satisfaction. These items were based on a measure developed by Andrews and Withey (1976). The questions gauge the respondent's feelings about his job, co-workers, the work itself, the physical surroundings, and the equipment, information, and supervision available to him. Responses were measured on a 7-point Likert scale, anchored by "delighted" (1) and "terrible" (7).

Self-rated Job Performance. Five items employing seven-point Likert scale responses are included to gather information on the respondent's own assessment of his job performance in relation to that of his fellow employees. The items were developed in-house and are based largely on the conceptual work on the composition of effectiveness by Mott (1972). Mott wrote that effectiveness criteria fall into three major categories: productivity, adaptability, and flexibility. Productivity criteria measure the quantity and quality of the product, and the effectiveness of the production process. Adaptability criteria include the anticipation of problems, keeping abreast of emerging

technologies, and the prompt acceptance of solutions. Finally, flexibility measures the ability to cope with unpredictable overloads of work. The AFIT survey's five self-rated performance items, consequently, measure quantity, quality, efficiency, ability to anticipate problems, and adaptability/flexibility. Possible responses range from "far worse" (1) to "far better" (7) in comparison with fellow employees.

Organizational Commitment. The 15 items intended to measure organizational commitment were adopted from Porter, Steers, Mowday, and Boulian's (1974) Organizational Commitment Questionnaire. The internal consistency reliability of their instrument was found to be high, ranging from .82 to .93 across four different time frames (Porter et al., 1974). The items attempt to measure the respondent's loyalty to the organization, his willingness to exert great effort to attain organizational goals, and his acceptance of the organization's values as his own (Porter et al., 1974). The AFIT survey's items are scaled on a 7-point Likert continuum, with responses ranging from "strongly disagree" (1), to "strongly agree" (7).

Job Involvement. Fifteen items were extracted from Saleh and Hosek's (1976) Job Involvement Index to measure job involvement in the AFIT survey instrument. Five items were adopted from each of Saleh and Hosek's three major

conceptualizations of job involvement. These three factors are: Central Life Interest, the degree to which the job situation is perceived to be a major source for the satisfaction of important needs; Work Participation, the degree to which an employee is participating in his job and meeting such needs as prestige, self-respect, and self-regard; and Self Concept, the degree to which the employee perceives that his job performance is central to his self-concept and self-esteem. These three definitions reflect the concept's multi-dimensionality. Attempting to measure job involvement according to a single conceptualization "...would probably fail to do justice to the complexity and conceptual richness of the construct" (Steel, Kohntopp, & Horst, 1983. p.16).

Steel, Kohntopp, and Horst (1983) tested the 15 items from Saleh and Hosek's Job Involvement Index in three samples of subjects. They obtained the following reliability data for the three factors: Central Life Interest, .87 - .91; Work Participation, .77 - .85; Self-concept, .63 - .93.

Participation in Decision Making (PDM). The survey includes five items designed to measure the extent of employee participation in decision making (PDM). The survey questions were based on a thorough review of the relevant literature, and developed in-house by AFIT researchers. (See Chapter 2, Literature Review). The response for each

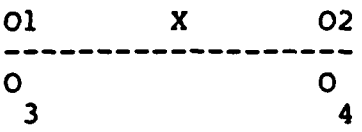
item is measured on a seven-point Likert scale, ranging from "strongly disagree" (1), to "strongly agree" (7).

Group Cohesiveness. The three items pertaining to group cohesiveness were also synthesized by the AFIT researchers after an extensive review of the literature pertaining to group cohesiveness. The items relate to team spirit, personal interest among coworkers, and group loyalty. The responses are arrayed on a 7-point Likert scale, anchored by "strongly disagree" (1), and "strongly agree" (7).

Intent to Remain. Kraut (1975) determined that intent to remain was a better predictor of turnover than even job satisfaction. Therefore, the survey uses intent to remain as a surrogate measure of turnover. A single item on the survey was designed to measure the respondent's intent to remain with the organization. A five-point Likert scale response is solicited to the following statement: "Within the coming year, if I have my own way ..." Possible responses ranged from, "I definitely intend to remain with the Air Force" (1), to, "I definitely intend to separate from the Air Force" (5).

Research Design

The impetus for this research is the need for empirically based, scientifically measured information on



The notations "O1" and "O3" symbolize pretest observations of the treatment and control groups, respectively. "X" designates the treatment, in this case the QC intervention. The symbols "O2" and "O4" represent posttest observations of treatment and control groups. The dotted line indicates that the two groups are not randomly equivalent.

A nonequivalent Control Group Design will facilitate attribution of changes in attitudinal and behavioral variables over time directly to the QC intervention. Some control for group nonequivalence is provided by adjusting statistically for any pre-existing differences between the two treatment groups.

Steel, Lloyd, Ovalle, and Hendrix (1982) report that the Nonequivalent Control Group design has been very effective in producing reliable and interpretable data on QC interventions. As discussed in Chapter 2, Literature Review, this design has yielded the most rigorous QC data to date.

Procedure

Each work group within the three organizations was afforded the opportunity to form into a QC. The on-site facilitator insured that this decision was strictly voluntary. Of the 119 work centers comprising the three

organizations, 10 chose to participate as QC groups.

The pre-intervention survey was administered over a two-day period by a representative of the AFIT staff. The pretest was administered to groups of 20 to 60 individuals at a sitting. A total of 689 individuals from the three organizations completed the pretest questionnaire. Each respondent was advised of the potential use of the information, and was assured of both confidentiality and anonymity. The disclosure of social security number was requested, but not made mandatory. The social security number was used as a means of matching pretest and posttest results by individual.

The ten volunteer groups subsequently began QC training, conducted by the on-site facilitator. The training consisted of ten hour-long sessions held during duty hours. At the conclusion of the training, the QC groups went into action within their work organizations, guided by their work group supervisor.

Approximately one year later, posttest results were collected. Out of the total number of individuals who completed the posstest, 223 had also responded to the pretest survey, so that the study group for this research effort was composed of these 223 matched cases.

Data Analysis

Demographic Analysis. Analysis of demographic

variables (age, education, sex, time in the organization, span of supervision, status, and paygrade) was accomplished for two purposes. First, t-tests were conducted in order to identify significant differences between pretest control and treatment (quality circle) groups. Secondly, the same statistical technique was performed in order to detect major shifts in the demographic characteristics of both control and treatment groups that may have occurred between pre- and posttests. Left undetected, these changes could have had a confounding effect on the interpretation of any QC treatment effects.

The demographic data was gathered through the first seven items on the AFIT Survey of Work Attitudes. Refer to appendix B for a listing of these items, and appendix A for a key to aid in the interpretation of the data.

Bivariate Correlation Analysis. The Pearson product-moment coefficient "r" was chosen to summarize the relationships between variables in the study. This index not only measures the strength of the association between a pair of variables, but also allows for the comparison of the relative strengths of the relationships between different pairs of variables (Nie, Hull, Jenkins, & Steinbrenner, 1975).

Also, since it is unlikely in social science research to derive a regresion line which perfectly fits the data, the Pearson product-moment correlation coefficient provides

IV. Results

Descriptive Statistics

Because purely random assignment to control and treatment groups was infeasible in this study, the identification of significant prestudy differences between the two groups was critical. The measurement of the demographic variables, age, education, tenure (i.e., time with the organization), span of supervision, status (e.g., officer, enlisted, GS employee), and grade, provided some indication of the degree of equivalence between the QC and control groups. QC and control group means for the demographic items were subjected to t-tests for both pretest and posttest measurements. Table III contains the results of this analysis and Appendix A is a key to the interpretation of the data.

The demographic analysis revealed no significant ($p < .05$) pretest differences between QC and control groups. Even without the luxury of random asignment, the groups started the study essentially equivalent on these demographic measures.

Posttest results indicate that a change in the composition of the groups occurred during the year-long interim between pre- and posttest measurements. In fact, three posttest variables demonstrated significant variance during t-test analysis: age, tenure and grade. While increases in the means of each of these variables were

Table III

QC and Control Groups Pretest and Posttest
Demographic Characteristics

Pretest

Variable	Quality Circle M	Quality Circle SD	Control Group M	Control Group SD	t
Age	1.93	1.17	2.20	1.26	1.26
School	2.48	1.52	2.19	1.52	1.10
Tenure	3.34	2.00	3.72	2.03	1.10
Boss	0.68	0.96	0.68	1.33	0.03
Status	1.05	0.61	1.16	0.78	0.88
Grade	1.64	1.31	1.88	1.27	1.15

Posttest

Variable	Quality Circle M	Quality Circle SD	Control Group M	Control Group SD	t
Age	2.03	1.13	2.43	1.32	1.72*
School	2.36	1.38	2.35	1.55	0.05
Tenure	4.28	1.54	5.02	1.23	3.19*
Boss	0.75	1.20	0.91	1.33	0.69
Status	1.06	0.58	1.29	1.07	1.25
Grade	1.56	0.65	2.10	1.30	2.45*

Note: Means are for 10 quality circles and 109 contol groups
Pretest QC N = 44
Pretest Control N = 179
Posttest QC N = 36
Posttest Control N = 185
*$p < 0.05$

expected, simply due to the passage of time, the control groups at the conclusion of the study were significantly older, had greater tenure, and were of higher grade than the QC groups. Since this study relied on matched pretest - posttest cases, the posttest difference, over and above that attributable to the normal passage of time, must be due to differential rates of attrition affecting the control and QC groups.

Correlation Analysis

The primary purpose of conducting bivariate correlational analysis on the attitudinal and behavioral variables in the study was to determine multicollinearity between variables. That is, to what extent does one variable contain information about another variable (Cohen & Cohen, 1975).

Table IV presents Pearson product-moment correlation coefficients between all pretest and posttest non-demographic variables. Except for the coefficients between pretest and posttest measures of the same variable, there was little evidence of redundancy or multicollinearity between the study's seven variables. The largest pretest intercorrelation, .39, was between measures of job involvement and organizational commitment. The largest posttest value, .28, involved commitment and job involvement. But in general, little multicollinearity was evident.

Table IV

Intercorrlation Matrix of Attitudinal Variables for Pretest and Posttest Survey Administrations

Attitudinal Variable	1	2	3	4	5	6	7
1. Organizational Commitment	(.47)*	.06	.19*	.20*	.28*	.18*	-.22*
2. Self-rated Performance	.06	(.31)*	.03	.08	.13	.04	-.08
3. Job Satisfaction	.27*	.08	(.24)*	.19*	.13*	.15*	-.11
4. Job Involvement	.39*	.11	.21*	(.53)*	.17*	.13*	-.16*
5. PDM	.26*	.06	.18*	.26*	(.30)*	.17*	-.13
6. Cohesiveness	.27*	.07	.23*	.23*	.16*	(.24)*	-.01
7. Intent to Remain	-.05	-.04	-.09	.07	-.10	-.08	(.22)*

Note: Values above the main diagonal are for the posttest, below the diagonal are for the pretest, and parenthetical correlations are coefficients of stability.

*$p < 0.05$

Tests of QC Effects

Mean Difference Analysis. Table V provides a comparison between QC and control group means at the pretest. No significant results were indicated at the .05 alpha level. This lends further credence to the assertion that QC and control groups were essentially equivalent at the beginning of the study. However, analysis using an alpha level of .10 yielded two significant differences between control and treatment groups. The two groups differed at the pretest in terms of self-rated job performance and job involvement.

At the posttest, one significant result emerged. Table VI reveals that the QC groups scored higher than did the control groups on the intent to remain variable. The intent to remain variable thus reflected a marginally significant change across time for the QC group (Table VII), and a significant result between treatment and control groups at the posttest. Otherwise, no systematic QC effect is evident among the posttest measures.

Tables VII and VIII present pretest and posttest variable means and t statistics for control groups and QC groups, respectively. Table VII reveals that at the .05 alpha level, the QC groups exhibited no significant changes in the seven attitudinal variables across time. Three marginally significant results are obtained at the $p < .10$ level. The intent to remain variable exhibited a

Table V

T-tests Between QC and Control Groups on the Pretest

	Control		QC		
Variable	M	SD	M	SD	t
Organizational Commitment	47.97	17.75	49.36	17.60	.047
Self-rated Job Performance	20.46	5.87	21.82	7.1	1.31**
Job Satisfaction	18.78	4.47	18.57	4.71	0.28
Job Involvement	9.87	8.46	11.73	8.51	1.30**
PDM	16.44	8.36	18.02	7.47	1.15
Cohesiveness	10.34	4.82	10.82	4.22	0.60
Intent to Remain	0.84	1.18	0.89	1.10	0.24

Notes: N for QC groups = 44
N for Control groups = 181
*p < 0.05
**p < 0.10

Table VI

T-test Between QC and Control Groups on the Posttest

Variable	Control		QC		t
	M	SD	M	SD	
Organizational Commitment	44.75	21.30	44.77	22.89	0.01
Self-rated Job Performance	21.20	5.54	21.30	5.76	0.10
Job Satisfaction	19.04	5.60	17.61	5.93	1.50**
Job Involvement	10.22	8.37	10.39	8.58	0.12
PDM	16.08	8.40	16.34	7.89	0.18
Cohesiveness	10.51	4.91	10.05	4.75	0.56
Intent to Remain	0.94	1.32	1.34	1.60	1.74*

Notes: N for QC groups = 44
N for Control groups = 181
*p < 0.05
**p < 0.10

Table VIII

T-tests Across Time for
the Control Groups

Variable	Pretest M	Pretest SD	Posttest M	Posttest SD	t
Organizational Commitment	47.86	17.77	44.81	21.37	1.97*
Self-rated Job Performance	20.39	5.85	21.14	5.53	1.54**
Job Satisfaction	18.83	4.45	19.07	5.53	0.56
Job Involvement	9.80	8.48	10.23	8.36	0.72
PDM	16.46	8.37	16.02	8.42	0.57
Cohesiveness	10.37	4.81	10.53	4.93	0.33
Intent to Remain	0.84	1.19	0.94	1.32	0.94

Notes: N = 179
*p = < 0.05
**p = < 0.10

significant increase from pre- to posttest measures. Organizational commitment and PDM also demonstrated a significant change, although in the negative direction.

The same negative trend is apparent in the control group analysis, shown in Table VIII. The fact that both groups experienced the same trend for these variables suggests that other exogenous organizational phenomena occurring during the study may have produced the negative change. Also, the fact the regression analysis failed to show significant changes indicates that these "negative trends" are unrelated to the QC intervention. With the exception of the decrease in organizational commitment, Table VIII contains no significant changes in the control group variable means across time at the .05 level. Analysis at the .10 alpha level reveals a significant increase in self-rated job performance across time.

Regression Analysis. The two-step hierarchical regression procedure described previously provided a more rigorous analysis of possible QC impact on the seven variables. The first step of the regression was designed to eliminate criterion variance attributable to pretest differences (cf. Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). The entry of the dummy variable (i.e., QC or control) in the second step identified the effects attributable exclusively to the QC intervention. Table IX contains the results of this regression analysis. No

significant increases in criterion variance were attributable to the QC treatment at the alpha = .05 level. However, using alpha = .10, the Intent to Remain variable showed a statistically significant result.

Supplemental Analysis

At the conclusion of this first phase of statistical analysis, when the anticipated results failed to materialize, a supplemental analysis was undertaken. During the course of the study, the researcher learned that certain QC groups had discontinued meeting during the course of the study. A supplemental analysis was performed which eliminated these groups from the treatment group.

The results of this supplemental analysis appear in Tables X and XI. A statistically significant mean difference was evident (on the pretest between QC and control groups) in the analysis of the Self-rated Job Performance. But again, no significant posttest differences emerged.

Summary

The survey instrument itself performed well. Little evidence of multicollinearity emerged in the correlational analysis, and the internal consistency reliability coefficients were in line with those generated in previous research.

Analysis of the means of the demographic variables

Table IX

Regression Analysis of QC Effects

Variable	R^2 Step 1	R^2 Step 2	ΔR^2 Step 1	ΔR^2 Step 2
Organizational Commitment	.217	.217	.217	.001
Self-rated Performance	.094	.095	.094	.001
Job Satisfaction	.060	.069	.060	.009
Job Involvement	.276	.277	.276	.001
PDM	.092	.092	.092	.001
Cohesiveness	.056	.058	.056	.002
Intent to Remain	.049	.061	.049	.013

Variable	Beta Step 1	Beta Step 2	F Step 1	F Step 2
Organizational Commitment	.466	-.014	61.454	.057
Self-rated Performance	.309	-.021	23.165	.102
Job Satisfaction	.243	-.095	14.050	2.155
Job Involvement	.529	-.038	85.222	0.442
PDM	.304	-.011	22.506	0.029
Cohesiveness	.238	-.047	13.360	0.528
Intent to Remain	.219	.112	11.298	2.968*

Notes: N = 225
*p < 0.10

Table X

T-tests Between Full-term QC
and Control Groups on Pretest

Variable	Control		QC		t
	M	SD	M	SD	
Organizational Commitment	47.97	17.75	48.10	17.17	0.02
Self-rated Job Performance	20.46	5.87	25.00	8.17	2.33*
Job Satisfaction	18.78	4.47	16.70	4.27	1.44**
Job Involvement	9.87	8.46	12.00	8.96	0.77
PDM	16.44	8.36	19.40	8.88	1.09
Cohesiveness	10.34	4.82	10.30	5.01	0.03
Intent to Remain	0.84	1.18	0.80	1.14	0.10

Notes: N for QC groups = 10
N for Control Groups = 181
*$p < 0.05$
**$p < 0.10$

Table XI

T-tests Between Full-term QC Groups and Control Groups on the Posttest

	Control		QC		
Variable	M	SD	M	SD	t
Organizational Commitment	44.75	21.30	52.50	19.87	1.12
Job Performance	21.20	5.54	23.90	4.41	1.51*
Job Satisfaction	19.04	5.60	18.70	6.63	0.18
Job Involvement	10.22	8.37	10.80	8.59	0.21
PDM	16.08	8.40	16.10	8.47	0.01
Cohesiveness	10.51	4.91	11.00	5.12	0.31
Intent to Remain	0.94	1.32	1.30	1.49	0.84

Notes: N for QC groups = 10
N for Control groups = 181
*p < 0.10

indicated no significant difference between QC and control groups at the pretest. The attitudinal variable analysis also suggests initial equivalency between treatment and control groups, although QC group means for self-rated job performance and job involvement were marginally higher than control group scores. At the posttest, the QC groups registered a significantly higher score for the intent to remain variable, but no other significant results emerged.

Likewise, the regresion analysis yielded no significant results, although intent to remain registered a marginally significant amount of variance attributable to the QC intervention. In general, no systematic QC effect was detected.

An interesting corollary finding was that the intent to remain variable surfaced in three separate analyses as registering either a significant ($p < .05$) or marginally significant ($p < .10$) result.

V. Discussion and Conclusions

In this chapter, a discussion of the findings stemming from the results of the statistical analyses described in the previous chapter is presented. The second section of the chapter is devoted to the author's conclusions about the study. Finally, recommendations for further research are outlined.

Discussion

While this study detected one marginally significant QC effect, no systematic effect across the seven variables analyzed was evident. This outcome does not necessarily indicate a failure of the QC intervention. Instead, there are several possible explanations for the study's nonsignificant results. First, the study may have employed insensitive or inappropriate variables as barometers of the QC effect. While careful consideration and research preceded the selection of the seven attitudinal variables on which this study focused, they represent only a fraction of the behavioral and attitudinal parameters measured by the AFIT Survey of Work Attitudes. Likewise, the AFIT survey itself focuses on a relatively narrow band of attitudinal variables in a spectrum of parameters that not only includes attitudinal measures, but direct organizational outcomes as well (Tortorich et al., 1981). In fact, since QCs are first and foremost a productivity improvement intervention,

perhaps a study of result-oriented indices, not attitudinal dimensions, would prove the more logical research strategy. In short, the QC intervention may have wrought profound changes in the treatment groups, but this study, using the wrong measuring stick, failed to detect them.

A second possible cause of the study's non-significant findings is that the QC intervention was conceptually valid, but poorly implemented. Goodman (1980) enumerated a list of potential obstacles to the viable implementation of Quality of Work Life projects such as QCs. Several of these factors may have been at work in this QC program. For instance, if the sponsorship of the QC program by the on-site facilitator and management was inadequate to begin with, or wavered as the intervention progressed, the viability of the intervention would have been threatened. Likewise, had the participants been unable to perceive adequate rewards stemming from the QC intervention, their support for the program may have been seriously eroded. Similarly, a lack of total system commitment, dissonance between QC value and organizational values, or a hostile organizational environment may have played a part in a poorly-implemented, but conceptually-sound program.

A third explanation for the study's results is the possibility that the QC program was conceptually unrelated to the objectives sought, or incapable of ever resulting in the desired goals. No matter how competently a program is

implemented, if there is no conceptual bridge between the intervention and the desired outcome, then the program must fail. So few objective QC evaluations have been undertaken that no clear link between the intervention and such outcomes as productivity enhancement has been established. In fact, Wood, Hull, and Azumi (1983) point out that the idea that QCs will improve American productivity is based on an assumption that QCs are responsible for the high productivity of Japanese manufacturers. That assumption may be invalid. First, most Japanese firms do not even use QCs. Second, in Japan the QC is "...only a small part of a comprehensive program emphasizing quality of life for employees and they are frequently maintained regardless of the extent to which they contribute to improvements in productivity" (Wood et al., 1983, p.42).

This study seems to echo the results of three recent research efforts each of which employed a similarly rigorous research design and also attempted to measure QC impact in terms of attitudinal change. Ham and McHenry (1983), Lyu and Roffey (1983), and Vaughn (1983) all found no significant attitude changes that could be attributed solely to QCs. These findings are in marked contrast to the glowing testimonials of the more subjective appraisals of QC interventions.

This study culminated one of the most ambitious QC research efforts undertaken within DOD. The potential size

of the population involved in the study was unprecedented, as was the length of time allowed for the experiment to mature between pretest and posttest. In addition, the experimental design employed represented a rigorous, scientific attempt to objectively measure the actual impact of a QC intervention. In spite of these apparent ideal conditions, several phenomena can be identified that may have confounded the results of the study.

Perhaps the methodological impairment most damaging to this study was experimental mortality, the changing composition of study groups over the course of the study (Emory, 1980, p.344). The analyses of both demographic and attitudinal variable means identified such shifts in group composition. While this phenomenon is not unique to military organizations, military personnel assignment policies tend to accentuate this organizational fluidity throughout DOD. Certainly it affected the outcome of this study. Of the more than 600 individuals who completed the pretest questionnaire, only 223 responded to the posttest survey a year later. These 223 cases of matched pretest and posttest surveys included 179 control group cases and only 44 QC group cases. It was this diminished sample that provided the data base for the statistical analyses conducted. While some of the "lost" cases can be attributed to incomplete or improperly coded optical scan response sheets, most of the attrition was the result of normal

fluctuations in military organizational composition through PCS moves, etc.

Another phenomenon that certainly contributed to the experimental mortality was the varying degrees of commitment to the QC intervention exhibited by the QC groups. While the on-site facilitator reported excellent participation by some of the QC groups, others embraced the QC principles with lesser degrees of enthusiasm, and several groups actually disbanded shortly after the initial training. It is impossible to know how different the study's outcome might have been had each treatment group employed the QC principles and techniques with the dedication envisioned by the researchers and facilitator. Certainly the wide variance of acceptance and commitment, not to mention the out-right rejection by several groups, contributed to the degree of experimental mortality experienced.

The second methodological impairment is a consequence of the first. In spite of efforts to include a sizable sample population in the study, the ultimate QC sample size was relatively small, partially attenuating the representativeness of the study. The limitations associated with an inadequate sample size became especially evident during the supplemental analysis conducted on what came to be considered the "purer" QC groups. After eliminating the five QC groups whose commitment to the program was considered suspect, only ten treatment cases remained. Even

if the analysis of these ten cases had produced more favorable results, serious doubts would have remained as to the generalizability of the findings to a larger population.

Conclusions

The statistical analyses of the seven variables selected for this study indicated no significant effect attributable to the QC treatment. Consequently, none of this study's hypotheses is supported.

While this study failed to detect a systematic change in the seven variables selected that could be unquestionably attributed to the QC intervention, it cannot be concluded that the concept, intervention, or the study were unsuccessful. The study contributes information to the body of knowledge of the impact QCs may have on human organizations, although the total accumulation of empirically based, scientifically gathered QC results is very small. Too small, in fact, to yet support a general conclusion as to the effectiveness of QCs.

This phase of the study was limited in scope due to time constraints. As a consequence, only a handful of variables were examined for evidence of a QC impact. By limiting the search for evidence to seven attitudinal variables, the study myopically focused on a very narrow band within a broad spectrum of available behavioral, attitudinal and objective variables. Tortorich et al. (1981) described the full spectrum of variables that may

reflect the results of a QC intervention: Direct Measures of program outcomes (e.g., the number of leaders and supervisors trained, the number of circles formed, volunteer and success rates, and direct cost savings); Personal outcomes (i.e., affective employee reactions toward their job situation); and Organizational outcomes (e.g., production, defect, attrition, and grievance rates). To conclude from this study that QCs do not work would be to dismiss the possibility that somewhere along this total spectrum of variables, QCs are exerting a measurable impact.

Recommendations

Time may be running out for the QC movement in DOD. One noted group of researchers suggests that QCs are already well into a cycle they have dubbed "adoption - disappointment - discontinuation" (Wood et al., 1983, p.37). American management's quest for a quick and easy fix for lagging productivity has often resulted in the adoption of new and promising concepts (MBO, and T-Groups, for instance). But unrealistic expectations, unquestioning acceptance and poorly planned and integrated implementation of the new ideas usually seal the fate of what is soon considered just another management fad.

Therefore, this study's first recommendation is for DOD to build into every QC intervention the means to objectively evaluate the effects of the program. The

evaluative research must continue in order to abort the cycle of adoption - disappointment - discontinuation that has typified previous dalliances with novel managerial concepts.

Second, it is recommended that future investigations into the efficacy of QCs expand their scope beyond the attitudinal variables currently in vogue. The thinking here is along two lines. First, as suggested earlier in this chapter, attitudinal variables are but a single subset of a much larger range of variables and outcomes, others of which may better record the positive effects of the QC intervention. Second, even if researchers can demonstrate that QCs significantly enhance job satisfaction, group cohesiveness and the like, what sells ideas in the DOD are harder measures: cost and time savings, reduced scrap and defect rates, for instance.

A third recommendation, and one whose implementation hinges on the completion of a great deal more research, is to adopt a contingency view for the adaptation of QCs in the DOD.

> A more theoretically based understanding of why and where QCs work and why they may 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 (Wood et al., 1983, p.49).

Given the tremendous organizational diversity within DOD, no single form of the QC model can be expected to produce

optimal results. Facilitators and managers must be prepared to custom-tailor the QC program to fit the unique characteristics and requirements of their organization.

A fourth recommendation is to avoid short-changing QC interventions by demanding instant and ambitious results. As suggested earlier in this study, changes in the dynamics of human organizations, as well as in individual attitudes, do not occur overnight. A considerable investment in time is required in order to foster the desired organizational responses, and then to accurately gauge the full effect of a QC program.

The QC intervention itself is critically dependent on a dedicated, professional, research-minded facilitator. As evidenced in this study, the initial enthusiasm for the QC intervention can quickly lapse into indifference and disillusionment, especially if results are not immediate and significant. Frequent inputs on the part of the facilitator may be required to help maintain the momentum of the QC group, at least until positive results begin to occur.

A final suggestion that might benefit future DOD studies, would be to select more stable organizations in which to study QCs. While military personnel policy is theoretically uniform across commands and career fields, certain commands and organizations tend to be less fluid than others. Also organizations composed predominantly of civilian personnel tend to exhibit greater stability than do

necessary for a QC intervention to have an impact on the organization, the more stable the composition of the group, the smaller the chance of experimental mortality.

Appendix A: Key to Interpretation of Demographic Data

Variable	Value	Meaning
Age	1	20 - 25 years
	2	26 - 30 years
	3	31 - 40 years
School	1	High School Degree
	2	Complete some college
	3	Completed Associate Degree
Tenure	2	1 - 6 months
	3	6 - 12 months
	4	12 - 18 months
	5	18 - 24 months
Boss	0	Supervised no employees
	1	Supervised 1-2 employees
	2	Supervised 3-5 employees
Status	1	Enlisted employee
	2	GS employee
Pay Grade	1	3 - 4
	2	5 - 6

Appendix B: AFIT Survey of Work Attitudes: Demographic Items

This section of the survey contains several items dealing with personal characteristics. This information will be used to obtain a picture of the background of the "typical employee."

1. Your age is:

    1. Less than 20
    2. 20 to 25
    3. 26 to 30
    4. 31 to 40
    5. 41 to 50
    6. 51 to 60
    7. more than 60

2. Your highest educational level obtained was:

    1. Non high school graduate
    2. High school graduate or GED
    3. Some college work
    4. Associate degree of LPN
    5. Bachelor's degree or RN
    6. Some graduate work
    7. Master's degree
    8. Doctoral degree

3. Your sex is:

    1. Male
    2. Female

4. Total months in this organization is:

    1. Less than 1 month
    2. More than 1 month, less than 6 months
    3. More than 6 months, less than 12 months
    4. More than 12 months, less than 18 months
    5. More than 18 months, less than 24 months
    6. More than 24 months, less than 36 months
    7. More than 36 months

5. How many people do you directly supervise (i.e., those for which you write performance reports)?

   1. None
   2. 1 to 2
   3. 3 to 5
   4. 6 to 8
   5. 9 to 12
   6. 13 to 20
   7. 21 or more

6. You are a (an):

   1. Officer
   2. Enlisted
   3. Civilian (GS)
   4. Civilian (WG)
   5. Non-appropriated Fund (NAF employee)
   6. Other

7. Your grade level is:

   1. 1-2
   2. 3-4
   3. 5-6
   4. 7-8
   5. 9-10
   6. 11-12
   7. 13-15
   8. Senior Executive Service

Appendix C: AFIT Survey of Work Attitudes: Job Satisfaction

Below are 5 items which relate to the degree to which you are satisfied with various aspects of your job. Read each item carefully and choose the statement below which best represents your opinion.

1 = Delighted
2 = Pleased
3 = Mostly satisfied
4 = Mixed (about equally satisfied and dissatisfied)
5 = Mostly dissatisfied
6 = Unhappy
7 = Terrible

1. How do you feel about your job?

2. How do you feel about the people you work with -- your co-workers?

3. How do you feel about the work you do on your job -- the work itself?

4. What is it like where you work -- the physical surroundings, the hours, the amount of work you are asked to do?

5. How do you feel about what you have available for doing your job -- I mean equipment, information, good supervision, and so on?

Appendix D: AFIT Survey of Work Attitudes: Self-rated Job Performance

The following statements deal with feedback you receive from your supervisor concerning your performance. Your frame of reference should be your supervisor's evaluation of your performance in terms of formal feedback (i.e., periodic, written performance appraisals) and informal feedback (i.e., verbal communication on a day-to-day basis). Please think carefully about his/her evaluations of you over the past six months or so.

Based upon the feedback you have received from your supervisor, use the rating scale below to indicate how your job performance would compare with other employees doing similar work.

1 = Far worse
2 = Much worse
3 = Slightly worse
4 = About average
5 = Slightly beter
6 = Much better
7 = Far better

1. Compared with other employees doing similar work, your supervisor considers the quantity of the work you produce to be:

2. Compared with other employees doing similar work, your supervisor considers the quality of the work you produce to be:

3. Compared with other employees performing similar work, your supervisor believes the efficiency of your use of available resources (money, materials, personnel) in producing a work product is:

4. Compared with other employees performing similar work, your supervisor considers your ability in anticipating problems and either preventing or minimizing their effects to be:

5. Compared with other employees performing similar work, your supervisor believes your adaptability/flexibility in handling high-priority work (e.g., "crash projects" and sudden schedule changes) is:

Appendix E: AFIT Survey of Work Attitudes: Organizational Commitment

Listed below are a series of statements that represent possible feeling that individuals might have about the company or organization for which they work. Use the following rating scale to indicate your own feelings about the particular organization for which you are now working.

1 = Means you strongly disagree with the statement.
2 = Means you moderately disagree with the statement.
3 = Means you slightly disagree with the statement.
4 = Means you neither agree nor disagree with the statement.
5 = Means you slightly agree with the statement.
6 = Means you moderately agree with the statement.
7 = Means you strongly agree with the statement.

1. I am willing to put in a great deal of effort beyond that normally expected in order to help this organization to be successful.

2. I talk up this organization to my friends as a great organization to work for.

3. I feel very little loyalty to this organization.

4. I would accept almost any type job assignment in order to keep working for this organization.

5. I find that my values and the organization's values are very similar.

6. I am proud to tell others that I am part of this organization.

7. I could just as well be working for a different organization as long as the type of work was similar.

8. This organization really inspires the very best in me in the way of job performance.

9. It would take very little change in my present circumstances to cause me to leave this organization.

10. I am extremely glad that I chose this organization to work for over others I was considering at the time I joined.

11. There's not too much to be gained by sticking with this organization indefinitely.

12. Often, I find it difficult to agree with this organization's policies on important matters relating to its employees.

13. I really care about the fate of this organization.

14. For me this is the best of all possible organizations for which to work.

15. Deciding to work for this organization was a definite mistake on my part.

Appendix F: AFIT Survey of Work Attitudes: Job Involvement

Use the following rating scale for the 15 statements to express your own feelings about your present job or work.

1. Means you strongly disagree with the statement.
2. Means you moderately disagree with the statement.
3. Means you slightly disagree with the statement.
4. Means you neither disagree nor agree with the statement.
5. Means you slightly agree with the statement.
6. Means you moderately agree with the statement.
7. Means you strongly agree with the statement.

1. I often have to use the skills I have learned for my job.

2. I often have a chance to try out my own ideas.

3. I often have a chance to do things my own way.

4. I often have a chance to do the kinds of things that I am best at.

5. I often feel at the end of the day that I've accomplished something.

6.* The most important things that happen to me involve my work.

7.* The most important things I do involve my work.

8.* The major satisfaction in my life comes from my job.

9.* The activities which give me the greatest pleasure and personal satisfaction involve my job.

10.*I live, eat, and breathe my job.

11. I would rather get a job promotion than be a more important member of my club, church, or lodge.

12. How well I perform on my job is extremely important to me.

13. I feel badly if I don't perform well on my job.

14. I am very personally involved in my work.

15. I avoid taking on extra duties and responsibilities.

Note: *Indicates the five items pertaining to Saleh and Hosek's (1976) "Central Life Interest" conceptualization. This subset of the Job Involvement items was used in this thesis.

Appendix G: AFIT Survey of Work Attitudes: Participation in Decision Making

This section of the questionnaire contains a number of statements that relate to feelings about your work group, the demands of your job, and the supervision you receive. Use the following rating scale to indicate the extent to which you agree or disagree with the statements shown below.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

1. Within my work-group the people most affected by decisions frequently participate in making the decisions.

2. In my work-group there is a great deal of opportunity to be involved in resolving problems which affect the group.

3. I am allowed to participate in decisions regarding my job.

4. I am allowed a significant degree of influence in decisions regarding my work.

5. My supervisor usually asks for my opinions and thoughts in decisions affecting my work.

Appendix H: AFIT Survey of Work Attitudes: Group Cohesiveness

This section of the questionnaire contains a number of statements that relate to feelings about your work group, the demands of your job, and the supervision you receive. Use the following rating scale to indicate the extent to which you agree or disagree with the statements below.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

1. There is a high spirit of teamwork among my co-workers.

2. Members of my work group take a personal interest in one another.

3. If I had a chance to do the same kind of work for the same pay in another work group, I would still stay here in this work group.

Appendix I: AFIT Survey of Work Attitudes: Intent to Remain

Use the rating scale given below to indicate your future work plans with respect to the Air Force or whatever equivalent service/company to which you belong.

1. Within the coming year, if I have my own way:

    1 = I definitely intend to remain with the Air Force.
    2 = I probably will remain with the Air Force.
    3 = I have not decided whether I will remain with the Air Force.
    4 = I probably will not remain with the Air Force.
    5 = I definitely intend to separate from the Air Force.

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VITA

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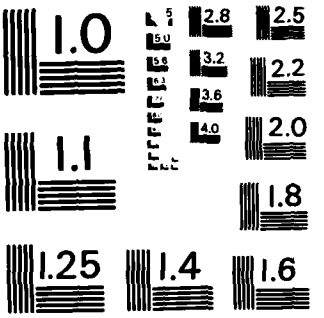

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Quality Circles (QC) have received considerable attention in both DOD and the private sector as a means of enhancing productivity and promoting human resource development. In contrast to the numerous subjective reports attesting to the effectiveness of this organizational intervention, very few empirical studies have been undertaken to objectively portray QC impact on the organization.

This thesis employed a non-equivalent control group design to assess the impact of a QC intervention at an Air Force base in the western United States. The study sought to measure the effects of the QC intervention on seven attitudinal variables: job satisfaction, self-rated job performance, organizational commitment, job involvement, participation in decision making, group cohesiveness, and intent to remain. Statistical analyses, including mean difference analysis and hierarchical regression analysis, revealed no systematic QC effect on these variables.

This thesis replicated the results of similarly-designed studies which also attempted to measure QC impact via attitudinal variables. It is recommended that DOD continue its efforts to empirically measure QC effectiveness, and that future studies expand their scope beyond the investigation of attitudinal outcomes.

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