**By Contribution**

# QCs' Effectiveness in Selected Industrial Enterprises in West Bengal

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*Organizations the world over are searching for new means for continuous improvement. One such search ends in Quality Circles (QCs). Starting in 1980s, the QC philosophy has spread throughout India, especially in the Eastern region including West Bengal (WB). The present study finds out the factors critical and responsible for QCs' effectiveness in five industrial enterprises in WB. Both primary and secondary data were collected during 2004-09 from 236 respondents representing 118 sample QCs. The data was analyzed by Principal Component Analysis and Factor Analysis with relevant validity analysis. Twenty-three 'factors' were extracted as critical and responsible for QCs' effectiveness. The success and effectiveness measure varies among the organizations and QCs. The 'factors' would act as the catalysts of QCs' effectiveness in any type of industrial setting.*

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## Importance of Quality Circles

Cut-throat competition and generally turbulent market conditions have forced most organizations the world over to restructure, cut costs, leverage through constant improvements in quality, customer satisfaction, technological improvements and adherence to safety standards. Success in the endeavours, however, lay in striking a balance between organizations' structure, technology and innovations on one hand and their culture, empowerment and man-management approaches on the other. The route to this lay in a number of Human Resources (HR) innovations, quality improvement programmes and initiatives, one of which is Quality Circles (QCs). Hutchins (1985) observed, "Quality Circles are the most exciting and profound approach to have been established in the world since the advent of scientific management". Presently, QCs represent the dominant form for involving employees in improving performance on the manufacturing floor in various industrial enterprises all over India including West Bengal (WB).

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The QC movement was formally introduced in Japan (though originally developed in the U.S.A. in the 1940s) way back in 1962. In India, the QC movement started in the early 1980s and Bharat Heavy Electricals Ltd. (BHEL) implemented the first successful QC programme in 1981 in its Ramchandrapuram unit (Udpa 1986). Since then, QCs have spread to many organizations all over India. In Eastern India, QC movement came into force with its successful implementation in Durgapur Steel Plant (DSP) in 1991-92. Some other notable organizations from WB practicing QC philosophy include, National Thermal Power Corporation (NTPC) Ltd., Farakka; Garden Reach Shipbuilders & Engineers (GRSE) Ltd., Kolkata; Exide Industries Ltd. (EXIDE), Haldia; Mitsubishi Chemical PTA India/ MCC PTA India Corporation Pvt. Ltd. (MCPI), Haldia; West Bengal State Electricity Board (WBSEB), Kolkata; Kolkata Port Trust; Peerless Hospital, Kolkata; Vivekananda Mission School, Kolkata; etc. But popularity alone does not guarantee effectiveness. It is therefore necessary to assess the effectiveness of this organizational tool.

The sample industrial enterprises in WB as selected for this study include three PSUs, DSP, Durgapur; GRSE Ltd., Kolkata; and NTPC Ltd., Farakka; and two private sector organizations, EXIDE, Haldia; and MCPI, Haldia. All of them have a history of successful and effective implementation of the QC philosophy and QC practices for the last ten years. Many of the sample QCs have also been working for many years now.

## Objectives of the Study

This empirical study has the following objectives:

- To determine the criteria for assessing QCs' effectiveness based on literature survey and develop a model.
- To use this QCs' effectiveness model to develop a questionnaire and conduct a survey among some sample industrial enterprises in WB.
- To subsequently extract the factors by using Principal Components Analysis (PCA) under Factor Analysis (FA) to find out the factors that have been responsible for QCs' effectiveness in the enterprises studied.
- To compare the model developed with the extracted factors for effectiveness.
- To recommend the requisite factors indispensable for QCs' effectiveness and suggest necessary steps for the sample industrial enterprises to develop the QCs and QC movement further.

## Research Methodology

The literature on workers' participation and QCs was surveyed extensively

to develop the QCs' effectiveness model of twenty-five factors. Thereafter, the primary and secondary data were collected from 2004 to 2009 in three phases from the sample industrial enterprises in WB, using a range of techniques- focused one-to-one interviews, group interviews, observations, survey questionnaires (both pilot and final) and verification (or checking) of the documentary sources/evidence in regard to the QCs in operation.

Based on the primary data as collected and the observations on the prevalent QCs activities in the sample industrial enterprises in phase I, a questionnaire was developed for pilot survey in phase II. During phase II, the pilot survey questionnaire was administered among the QCs' members and leaders/ deputy leaders (50% of the sample QCs and its members were included) comprising 118 statements. Thereafter, a thorough analysis of the responses of pilot survey questionnaire was used to eliminate the less important statements for the final questionnaire survey in Phase III. In this regard, the recommendations of Guilford (1952) has been followed that at least three statements representing each factor of the QCs' effectiveness model (as developed initially) should be kept in the final survey questionnaire balanced with reliability estimation. In phase III, the final questionnaire (comprising 96 statements and other general questions, totalling 100 questions) survey was conducted among the 236 respondents (representing 118 QCs, i.e., two members from each QC, selected on a stratified basis and as per their availability) from the five sample industrial enterprises for further investigation and analysis. Only those active QCs which were more than two years of age (i.e., the honeymoon effect has gone) were selected. The questionnaire used a 5-point Likert Scale, ranging from 'Strongly Disagree' (=1) to 'Strongly Agree' (=5), to obtain primary data from the respondents.

In this study, Kaiser, Meyer and Olkin's (KMO) 'Measure of Sampling Adequacy' (MSA) Test was conducted to find out whether FA application is justified or not. The KMO MSA has come as 0.587. The value has been acceptable as per Kaiser's (1970) suggestion and it has been taken as the basis for selecting FA to find out the most significant (principal components) and influential factors as prevalent in the sample industrial enterprises for making their QCs effective.

**Literature Review**

The literature on QCs has been largely non-empirical in nature involving successful and unsuccessful stories from varied organizational settings all over the world. Many formal studies on QCs deal with selected aspects of their implementation, outcomes and success or failure factors. This study has focused mainly on success or failure factors of QCs in the works of Dale (1984), Dale and Lees (1985), Griffin and Wayne (1984), Hill (1991), Hill and Wilkinson (1995), Ingle (1982), Lawler and Mohrman (1985), Mento (1982), Metz (1981), Sen (2003, 2010), Sodhi et.al (1995), Udpa (1986), White & Bednar (1983), etc. A number

of conceptual papers on QCs (Nishiyama 1981, Ramsing & Blair 1982, Wood, Hull & Azumi 1983) had become the root theory of QCs application in various countries.

In the Indian context, QC implementation process and activities in different organizations (Dwivedi 1987a, Jha 1997, Mathew 1985, Srinivasan 1991, Udpa 1985) and QCs' effectiveness evaluation in industrial settings (Dwivedi 1987b, Khan 1986, Vijaya Banu 2007) were studied. However, no regional study of this kind in WB was found. Hence, this study would be one of pioneering nature within this region. But many of the findings could as well be true of other regions or organizations in India. As Wood, Hull and Azumi (1983) pointed out, a more theoretically based understanding of why and where QCs work and why they might fail, when substantiated by research data, would help provide managers with the principles needed for selecting the best aspects and institutional requirements of the QC's model and adapting them to the situation in local organizations or situations.

**The Quality Circle (QC) Philosophy**

Quality Circle Forum of India (QCFI) (1983) defines a QC as: "A small group of employees in the same work area or doing similar type of work that voluntarily meets regularly for about an hour every week to identify, analyse and resolve work-related problems". As an approach to participative management, QC philosophy/concept incorporates the idea that employees at all organizational levels want to be involved in decisions that affect their work, and that those closest to a given job are in the best position to evaluate its problems and suggest potential solutions.

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Motivation, participation and recognition are the three major aspects of the QC philosophy and programmes for employees at the grass-roots. Job satisfaction and teamwork are the two driving forces behind all motivational activities. The QC philosophy encourages each individual to develop to the best of his/her ability. It offers a cooperative group to belong to.

In the Indian context and for Indian organizations, Dwivedi (1987a) attributed the following QC objectives:

- To enrich Quality of Work Life (QWL) of employees
- To instil respect for humanity and build a meaningful and bright workshop, conducive to work
- To usher in participative management in the real sense
- To give opportunity to employees to use their wisdom and creativity

- To encourage team spirit, cohesive culture, create harmonious human relations and strengthens bonds of brotherhood among different sections and levels of employees
- To promote self and mutual development
- To develop leadership qualities
- To satisfy the self-esteem and self actualisation needs of people

In general, the benefits derived from QCs can be classified into two broad categories;

- Tangible benefits, and
- Intangible benefits.

Tangible benefits include reducing defects and wastes and improvements in quality of products/services, productivity, safety and cost-effectiveness. Intangible benefits include promotion of a voluntary participative culture, improvement in teamwork, enhancement of problem-solving capabilities of QC members, improvement in human relations and work area morale and all-round personal development of the QC members.

**Framework for Effectiveness:**

Available QCs literature from all over the world was studied minutely to find out the factors which can be used to evaluate the effectiveness of QCs' activities in an organization. After a thorough analysis of various published resources, comments, viewpoints, discussions and observations of many researchers as well as practitioners, this researcher has come to the conclusion that for judging QCs' effectiveness, the critical factors can broadly be classified into two categories: quantitative and qualitative. Some factors like QC tenure (age of a QC), number of problems/ projects solved, money saved as a result of QC solutions, attendance rate in QC meetings constitute quantitative evaluative criteria. In regard to qualitative factors, employee development through QC participation and organizational development as a result of QCs' functioning, have been taken as evaluative criteria.

The QCs' effectiveness model [twenty-five factors] includes:

- Top management commitment and support,
- Organizational requirements and support,
- Middle management commitment and support,
- Employees' attitude and objectives in joining QCs,
- Facilitators' commitment and support,
- No resistance from trade union,
- QCs members' commitment and support,
- Provision of comprehensive training,
- A minimum level of education, skills and knowledge of QC philosophy,
- Keeping the main focus on voluntary participation approach,

- Strong group dynamics,
- Effective leadership in QCs,
- Satisfaction with job and non-job factors in the workplace,
- Adequate number of suitable problems/projects for QCs,
- Selection of simple problems/projects for QCs,
- Regularity of QCs meetings and QCs activities,
- Free-flowing and effective communication system,
- Clear-cut QC objectives and logical expectations from QC groups,
- Publicity and recognition by management,
- Suitable reward schemes/system,
- Maintenance of initial enthusiasm and spirit in spite of age of QC,
- Taste of success with existing QCs,
- Supportive national, local and social culture,
- Continued presence of key personnel, and
- Procedural effectiveness in implementing QCs' solutions/recommendations.

**Empirical Study & Findings**

In this study, PCA under FA (for extraction of factors) and Varimax Rotation with Kaiser Normalisation methods to the 89 statements ( 7 statements with extreme scale values, i.e., either all 1 or all 5 or a combination of 1 and 5 only, have been excluded for representing dichotomous questions) was applied to derive the most significant (principal components) factors of QCs' effectiveness being present in those sample industrial enterprises in WB.

The FA procedure automatically identifies factors that explain more variance than individual statements. The twenty-three factors in Table I account for approximately 82.33 percent of the total variance among the statements, which are quite satisfactory. Using a criterion of eigen values greater than one, followed by the varimax rotation and a scree-test, these twenty-three factors have been identified. Due to the sample size, only variables with a factor loading of .600 or higher have been selected.

Based on the results, it has been found that 25.85 percent of variance was caused by factor 1. Thus 'Organizational and Top Management Support for QCs Activities' is the most significant 'factor' contributing towards QCs' effectiveness in sample organizations. Factor 2, 'Regularity of QCs Meetings and QCs Activities', (with 6.24 percent) and Factor 3, i.e., 'Keeping the Main Focus on Voluntary Participation Approach' (with 5.383%) also contribute significantly to QCs' effectiveness. All other factors individually contribute less than 5 percent of variance towards QCs' effectiveness.

**Table 1 QCs' Effectiveness Factors (in respect to all Sample Industrial Enterprises) Based on PCA under FA**

| Items (Components) | Loadings |
|---|---|
| **Factor 1: Organizational and Top Management Support for QCs Activities** | **(25.848%)** |
| 10. For and during all such QCs competitions (of all types), the expenses for participation, journey, hospitality, recreational tours, additional D.A.- if any, etc. are fully borne by our organization. | .795 |
| 8. The top management implements our QCs' solutions/recommendations instantaneously or provides the necessary assistance (including funds) to implement such solutions/recommendations in time. | .789 |
| 9. Our QC regularly participates in different intra-organizational, local, zonal, national and international (if selected) QCs competitions. | .788 |
| **Factor 2: Regularity of QCs Meetings and QCs Activities** | **(6.240%)** |
| 13. We have a written QC Code of Conduct to follow for all QC activities. | .779 |
| 81. Our QC meetings and all other QC activities are held as per the framed QC Rules and written QC Code of Conduct. | .705 |
| **Factor 3: Keeping the Main Focus on Voluntary Participation Approach** | **(5.383%)** |
| 96. In our organization, we have volunteered to participate in the QCs' activities and also have selected our leader/leaders without any type of management interferences. | .921 |
| **Factor 4: Facilitators' Commitment and Support** | **(4.540%)** |
| 44. Our QC facilitator is a mentor/guide to us at all point of time (both difficult and easy). | .804 |
| 46. Our QC facilitator is the main driving force/ inspiration behind our QCs' successes and effectiveness. | .799 |
| **Factor 5: Adequate Number of Suitable Problems/Projects for QCs** | **(3.807%)** |
| 74. Our QC has solved one/many problem/problems which is/are inter-departmental in nature during its tenure. | .760 |
| **Factor 6: Provision of Comprehensive Training** | **(3.568%)** |
| 4. I think that such formal QC trainings have developed our general knowledge-base and skills (such as, technical, work-related, group dynamics, leadership, communication, etc.) level than before joining the QC activities. | .900 |
| 5. I think that such suitable and adequate training is absolutely essential to be successful and effective in QC activities. | .854 |
| 2. We have been provided suitable and adequate training in all the steps of QC activities and QC philosophy. | .752 |
| **Factor 7: No Regular Rotation of QCs Members** | **(3.155%)** |
| 49. Our QC members are regularly turned over/ transferred. | .842 |
| 51. I think that regular rotation of members is absolutely essential to make the QC problem-solving process successful and effective. | .836 |
| **Factor 8: QCs' Members Psychological Development** | **(2.823%)** |

*Contd...*

| | |
|---|---|
| 70. After joining QC my commitment towards productivity and regularity in work has enhanced. | .837 |
| 54. I have become much more motivated and satisfied after joining QC than earlier. | .805 |
| **Factor 9: Active Involvement and Commitment from the Departmental Heads/Supervisors** | **(2.732%)** |
| 21. Our departmental head/supervisor may or may not be acting as the facilitator of our QC, is present in most of our QC meetings. | .770 |
| **Factor 10: Regular Active Participation of All QCs Members in QCs Activities** | **(2.443%)** |
| 64. All of us regularly participate in all the QC activities. | .740 |
| **Factor 11: Middle Management Commitment and Support** | **(2.289%)** |
| 19. We get regular and continuous training and suggestions to improve ourselves in QC activities from our middle management/departmental head/supervisor. | .799 |
| 18. I have joined the QC activities because of the active involvement and inspiration of our middle management/departmental head/supervisor. | .754 |
| **Factor 12: Successful QCs' Leadership Tenure** | **(2.230%)** |
| 34. I enjoy the power status, authority-responsibility position and recognition in my QC leadership tenure. | .876 |
| 35. The success as a QC leader has given me the necessary boost and experience to tackle future situational problems anywhere. | .851 |
| **Factor 13: Procedural Effectiveness in Implementing QCs Solutions/ Recommendations** | **(2.171%)** |
| 76. We periodically assess the performance of earlier QC solutions/ recommendations undertaken in our QC in the past and act to continuous improvement of those. | .700 |
| **Factor 14: Continuous Technical Support from the Departmental Heads/Supervisors for QCs activities** | **(1.942%)** |
| 25. Our departmental head/supervisor may or may not be acting as the facilitator of our QC, always help in the preparation of speeches and PowerPoint presentations for all types of QCs competitions. | .822 |
| **Factor 15: QCs' Members Communicational Ability and Skills Development** | **(1.806%)** |
| 85. My active participation in QC activities all these years has improved my communicational ability and skills individually and within groups in QC. | .760 |
| **Factor 16: Effective Leadership in QCs** | **(1.735%)** |
| 66. Our QC leader is supportive, nondirective and non-evaluative. | .986 |
| 67. We always approach our QC leader first whenever we face any problem in QC activities for his/her suggestions/advices and mostly he/she listens us carefully. | .982 |
| **Factor 17: Free-Flowing and Effective Communication System in QCs** | **(1.664%)** |
| 63. We freely discuss all QC matters in formal (QC meetings) and informal discussions in our QC. | .625 |
| **Factor 18: Employees' Attitude and Objectives in Joining QCs** | **(1.573%)** |

*Contd...*

| | |
|---|---|
| 32. I think that the QC is a medium to show my creativity and other intrinsic qualities, such as, intelligence, organizational and leadership abilities, decision-making skills, etc. before the management/superiors. | .850 |
| **Factor 19: Existence of Other Quality Improvement Programmes in the Past and/or in Present** | **(1.446%)** |
| 14. Our organization had/has Quality Improvement Programmes, such as, Work Councils, Suggestion Schemes/Systems, any other WPM Programs, TQM, Quality Assurance/Control, etc. in the past or currently working simultaneously with the QCs. | .862 |
| **Factor 20: QCs' Stability Throughout Their Tenure** | **(1.341%)** |
| 95. In the past, on one/some/many occasions, our QC had/has been parted to form new QCs. | .710 |
| **Factor 21: Top Management Commitment and Involvement** | **(1.280%)** |
| 1. I have joined the QC activities because of the active involvement and inspiration of the top management. | .732 |
| **Factor 22: Selection of Simple Problems/Projects for QCs** | **(1.187%)** |
| 78. The complex nature of QC-selected problems which require inter-departmental, inter-work-area assistance has never stopped the functioning of our QC or make us demotivated to continue the QC activities. | .800 |
| **Factor 23: QCs Members' Commitment and Support** | **(1.131%)** |
| 57. We maintain all the QC-related records (such as, Minutes Book of QC meetings, QC-Records Book, etc.) by our own. | .778 |

In a nutshell, commitment and wholehearted support from all concerned including the organization, necessary organizational requirements, technical soundness of the QCs' activities and above all the objectives, attitudes, skills and the developmental and motivational factors (as reaped under QCs) of the QCs' members have been proved as necessary and indispensable. It has been found that many factors which are indispensable for QCs' effectiveness in the sample industrial enterprises in and around Kolkata, as per the above FA results, exist also in the QCs' effectiveness model as developed.

For the study purpose, the magnitude of the Cronbach Alpha estimate is appropriate for the proof of the reliability (Henson 2001). Therefore, to fulfill the reliability aspect in this study, Cronbach Alpha has been arrived at to secure reliable item coefficients or scale reliability of the total items (statements) and for each individual factor.

**Table 2 Reliability Analysis– Scale (Alpha)**

| Number of Items (Statements) | Cronbach Alpha |
|---|---|
| 89 | .8685 |

**Table 3 Reliability Analysis – Scale (Alpha) of Factors**

| Factor No. Items | Number of (Statements) | Cronbach Alpha |
|---|---|---|
| 01 | 03 | .8253 |
| 02 | 02 | .8122 |
| 03 | 01 | - |
| 04 | 02 | .9964 |
| 05 | 01 | - |
| 06 | 03 | .8336 |
| 07 | 02 | .7566 |
| 08 | 02 | .9650 |
| 09 | 01 | - |
| 10 | 01 | - |
| 11 | 02 | .7198 |
| 12 | 02 | .9445 |
| 13 | 01 | - |
| 14 | 01 | - |
| 15 | 01 | - |
| 16 | 02 | .9722 |
| 17 | 01 | - |
| 18 | 01 | - |
| 19 | 01 | - |
| 20 | 01 | - |
| 21 | 01 | - |
| 22 | 01 | - |
| 23 | 01 | - |

Note: If there is only one item (statement) for a factor, Cronbach Alpha cannot be calculated.

The standard thumb rule is that the Cronbach Alpha must be greater than approximately .70 to conclude that the scale is reliable. So, in case of total items (statements) and some individual factors (incorporating more than one item), the scale has been found to be reliable.

## Conclusion

It was found that effectiveness of the QCs was varying across sample organizations and QCs. In most of the organizations, the overall QC movement shows declining momentum. There is evidence that QCs' effectiveness is conditional and/or influenced by the overall organizational culture, wider participative structures and so on. Also, neither employee commitment nor employee satisfaction with QCs has been uniform even in the same organization. In some of the organizations, such as, DSP, Durgapur; EXIDE, Haldia, it was found that the members and non-members are very excited and enthusiastic with the QC philosophy and activities. In some other organizations, such as NTPC Ltd. Farakka and MCPI Haldia, excessive work pressure is causing less time available for QCs' activities.

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The primary contribution of this research has been to develop a new organization-oriented QCs' effectiveness model which is also time-tested. It has tracked the responses of the respondents to QCs-participation over time (during the three phases). It has used the FA logically and reliably for extracting 'factors' based on the primary data. It has employed a comparative analytical study (QCs' effectiveness model vs. the overall extracted 'factors'). This study was not a mere narrative of some organizational participants or self-reported by either the management or the unions.

But, the study is not free from limitations. Time and resource constraints make this study limited in numbers and dimensions. Issues related to complex-

ity, importance, quality, timing and difficulty of the problems/projects and their solutions have not been examined in the present research. However, it is reasonable to expect that these factors could clearly impact both the speed and quantity of QCs' problem-solving. Future research should include self-reported and other types of primary data (including questionnaire study) in examining QCs' effectiveness in terms of the QCs' problem solving and QCs' productivity.

Based on this work, the researcher has suggested and recommended the following prerequisites/factors as essential for the sustained long-term success and effectiveness of individual QCs and the overall QC movement in different organizations (including the sample ones) in WB (also in any other Indian organizations):

1. The QC philosophy should be integrated in to the basic organizational structure and policy framework. Also, the organizations need to capture and follow the true spirit of the QC philosophy in all regards.

2. An organizational environment of strong group-cohesiveness, mutual understanding, trust and fellow-feeling, positive union relations, etc. are found necessary for QC success. Above all, a democratic atmosphere is the essence (i.e., voluntary participative approach) of the QC philosophy and may be considered as indispensable for their successful and effective working.

3. It would be always best to begin the QC movement (i.e., the launching of initial QC/QCs) in an area with a high probability of success. To cope with the initial resistance (if any), the initiator or top management has to continuously conduct awareness campaigns for the QC philosophy within the organization at all levels. In organizations where the top management has won the confidence of all sections on most issues, it is relatively easy to handle the resistance towards change, and in implementing QCs.

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4. A separate QC Cell should be developed (possibly under the aegis of the TQM/Quality Control/any other Department, as in DSP, Durgapur) to look after QC efforts in the organization.

5. QCs' success and effectiveness should not be judged only from performance in different QCs Competitions, but, rather from the importance of the solutions/recommendations of problems in their respective work-areas. More and more emphasis should be put on regular visits by management to QCs' work-areas to verify the progress of QCs activities and obtain necessary feedback from QCs members.

6. A lucrative monetary reward schemes/system based on a percent-

age of the total money saved (post-audit) should be offered to QCs members to motivate them further, though, this violates the basic QC philosophy. This would be much more logical, scientific and attractive than the existing one-time 'Cash Award' schemes as generally prevalent in the sample industrial enterprises.

7. Successful QCs and their members should be encouraged to interact with newly-formed or inactive, ineffective or unsuccessful QCs and their members to share the experiences and successful practices.

8. Last, but not the least, all organizations practicing and wanting to introduce/launch the QC philosophy should be focused on improving the QWL and social and family life of the QCs members as a priority.

In conclusion, when properly implemented in the right industrial culture, QCs could help create a competitive drive far beyond the experience of anyone who has not seen them in operation. However, when badly managed, QCs result in failures, disappointment and cynicism and distrust of the concept of QC (Hutchins 1985) and could become a management fad (O'Donnell & O'Donnell 1984).

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