Chapter 8

Kaoru Ishikawa

'At last,' he said, '*el pueblo*'.
(Salvador Allende, President of Chile,
cited by Beer, 1981: 258)

KEY LEARNING POINTS

Kaoru Ishikawa's definition of quality: quality of product, service, management, the company itself and the human being.

Key beliefs: systemic approach; participation; communication.

Principal methods: seven tools of quality control; the fishbone diagram; quality circles.

INTRODUCTION

Kaoru Ishikawa, who died in 1989, commenced his career as a chemist, held a doctorate in engineering and was an emeritus professor at Tokyo University. Bank (1992: 74) describes him as the 'Father of Quality Circles' and as a founder of the Japanese quality movement. He became involved in quality issues in 1949 through the Union of Japanese Scientists and Engineers (JUSE) and subsequently became a world-wide lecturer and consultant on quality. Gilbert (1992: 23) suggests that Ishikawa was the first guru to 'recognise that quality improvement is too important to be left in the hands of specialists'. Ishikawa's writings explaining his approach include the *Guide to Quality Control* (1986) and *What Is Total Quality Control? The Japanese Way* (1985), which have both been translated into English. Ishikawa was widely honoured for his work, receiving the Deming, Nihon Keizai Press and Industrial Standardization prizes and the Grant Award from the American Society for Quality Control.

8.1 PHILOSOPHY

Gilbert (1992: 23) and Logothetis (1992: 95) see the philosophical roots of Ishikawa's work in the concept of Company-Wide Quality. Ishikawa himself, cited by Bendell (1989: 18), said, 'The results of these company-wide Quality Control activities are remarkable, not only in ensuring the quality of industrial products but also in their great contribution to the company's overall business'. Bendell (ibid.) proposes that Ishikawa defines quality as meaning 'not only the quality of the product, but also of after sales service, quality of management, the company itself and the human being'.

Flood (1993: 33) interprets Ishikawa's approach as involving 'vertical and horizontal co-operation'. Thus the approach takes account of communication and co-operation between different levels of managers, supervisors and workers, and from suppliers to customers. Ishikawa's first belief, then, is that everyone involved in or affected by the company and its operations should be involved in the quality programme. This is similar to the 'total' approach advocated by Feigenbaum (see Chapter 7).

The level of involvement proposed is also significant. Ishikawa asks that the programme not just be company-wide (and beyond) but that it involve active participation. His approach to participation emphasizes greater worker involvement and motivation, which Bendell (1989: 19) sees as being created through:

- an atmosphere where employees are continuously looking to resolve problems;
- greater commercial awareness;
- a change of shop floor attitude in aiming for ever increasing goals.

These strands stress three words, all of them qualitative rather than quantitative: atmosphere, awareness and attitude. They are cultural requirements which have direct implications for the behaviour of management.

An 'atmosphere where employees are continuously looking to resolve problems' implies acceptance by management that:

- Workers have the ability to recognize both problems and solutions.
- Management will either accept the need for change and implement proposals, or explain why a proposed change is not possible or desirable in a way which maintains the employees' enthusiasm.

A 'greater commercial awareness' imposes two responsibilities on management. First is to provide or enable training and education for the workforce in this area. Second is to provide to the workforce accurate, meaningful and timely data in respect of the company's performance, as well as that of its competitors. Although commercial awareness is stressed in this regard, these matters should be considered equally important in a public sector or not-for-profit organization, which, rather than focusing on profit, should be focused on delivering the maximum level of service within a constrained resource – that is, value for money.

The third strand, 'a change of shop floor attitude' towards a focus on ever-increasing goals – the culture of continuous improvement – again implies management responsibility. Management must adopt this attitude in their behaviour as well as their words to make its

achievement possible. Deming's concern about 'exhortations' is important here, as well as Crosby's promotion through slogans and platitudes.

Clearly, Ishikawa believed that effective participation, like effective communication, is a two-way street, and as suggested by Hagima Karatsu, managing director of Matsushita Communication (cited by Bendell, 1989: 19), 'creative co-operation' between people is an absolute requirement for a quality organization.

Another element of Ishikawa's work is its emphasis on direct, simple communication. According to Bendell (1989: 17), Ishikawa saw 'open group communication' as critical, particularly in the use of his tools for problem solving. A fundamental part of communication for Ishikawa seems to have been an emphasis on simplicity in his methods. For example, his book *Guide to Quality Control* (1986) was deliberately written as a 'non-sophisticated' text, and Bank (1992: 75) suggests that Ishikawa worked in a 'straightforward manner'. Logothetis (1992: 95) stresses that Ishikawa concentrated on 'simple statistical techniques for data collection and presentation'. The requirement for simplicity covers both the qualitative and quantitative issues.

The emphasis on simplicity and using what might be called the language of the shop floor is considered to have an empowering effect. The workers, having been trained in the appropriate methods, are not obliged to use obscure or arcane terminology. Management are unable to hide behind complex approaches and sophisticated language, which in many cases betray a lack of real understanding. Since training is given to all levels of employee, a common quality language is spoken by all, which in turn aids and enhances communication.

Three principal strands can be identified in Ishikawa's philosophy. First, in company with Feigenbaum, is the systemic or holistic approach advocated by 'Company-Wide Quality', an all-embracing view. Second is participation, active and creative co-operation between those affected. The third element is the emphasis on communication through two strands of thinking: simplicity of analysis and method, and commonality of language.

8.2 ASSUMPTIONS

Ishikawa's apparent assumptions about the world will now be explored.

It can be seen that his first assumption is concerned with interrelatedness, a 'total' or systems view. He explicitly recognizes that every aspect of the organization and the relevant parts of the environment must be considered. As with Feigenbaum, it is difficult to argue with that approach, although whether Ishikawa's techniques and methods may be thought of as systemic will be considered in the next section, since some of them seem to rely heavily on a reductionist perspective.

Ishikawa's second assumption is that a fully participative approach can be adopted. This implies a belief that every individual within the organization can, and will, commit themselves to addressing the quality issue. This suggests that a quality 'religion' or creed must become established, and the achievement of higher quality become a superordinate goal, overriding all others as a requirement for organizational success. The primacy of this goal, while perhaps accommodating the requirements of the management or even the owners or shareholders, seems to assume that the primary goals of the workforce will be congruent with those of the organization. However, little is said about how such a state can be achieved, and for example

Bendell (1989: 19) says that '[quality] circle members receive no direct financial reward for their improvements'. Commitment to quality, then, very like religious belief, is considered to be its own reward! This can be contrasted with Crosby's dictum to reward those who contribute to the quality programme.

A further assumption implied is that the quality activity takes place in an organizational environment which is free from political or power relations between participants. While this may be an admirable ideal, it must be perceived as being unrealistic. Both Eastern and Western organizations are subject to internal issues of power and, potentially, coercion. These may be dominant or subordinate issues in the management of the organization but they nonetheless exist. Ishikawa is silent on this aspect and how it may be addressed, perhaps reflecting the strength of his own position, or a lack of awareness of the problems faced by others who are less educated or in less privileged positions. Alternatively, it may simply reflect the strongly collective nature of the Japanese value system.

The third assumption, effective communication, is to some extent associated with the second. Participation relies on effective communication for its success. While the development of a common 'language' for discussing quality issues throughout the company is considered to be a substantial benefit in this regard, it is still possible that communication will be inhibited by cultural or political issues which prevent viewpoints from being expressed. For example, respect for age or status, or fear of loss of face, may prevent an open exchange of views, without which no real communication takes place. The 'loser' in the transaction, who may have a valid viewpoint, is not heard.

Finally, we can turn to the assumption that 'simplicity' in technique and method is useful. While acknowledging that the sophistication of tools must match that of the people who work with them, Ishikawa's work to some extent may be seen as undervaluing or underestimating the people in the organization in assuming that they can cope only with simple concepts and methods. If the complexity of life for an individual is considered, in either the West or the East, it must be recognized that the majority of people deal extremely well with a highly complex existence. For example, coping with accommodation requirements, raising children and managing families (surely the ultimate management challenges), organising pensions and health matters, dealing with state bureaucracies, even driving a car, require complex problem-solving and organizational skills. These skills are rarely articulated and acknowledged, but nonetheless they exist and are used for the most part very well. To assume, as Ishikawa appears to, that everything must be simplified is perhaps arrogant. To forget that, starting from simple skills that we all acquire as children, we can develop through education and experience the ability to handle greater complexity is to underestimate the potential of the workforce and perhaps sow the seeds of future discontent.

A second assumption Ishikawa apparently makes is that problems of quality will be tractable when examined using simple methods and approaches. Products and services are considered by many to be becoming more complex, as are the environments in which organizations exist and the organizations themselves. There are increasing numbers of interrelationships between factors; at the same time, there are perhaps more factors to be considered. The complexity of any situation may be suggested to be increasing through these two prime driving forces. Experience suggests that simple problem-solving approaches are unlikely to be adequate in these circumstances. Other, more sophisticated but not necessarily less accessible tools must

be used. Despite their increasing availability and prominence, especially in Western nations during Ishikawa's time, he does not appear to have taken account of them. Some, as will be seen in Part four of this book, reflect values in relation to the workforce which accord well with those of Ishikawa and would have, perhaps, enhanced his approach.

8.3 METHODS

Ishikawa's overarching method is Company-Wide Quality Control. This he sees as being supported by the quality circles technique, and the 'seven tools of quality control'. These will be dealt with in turn.

Company-Wide Quality Control has already largely been addressed as the founding philosophy of Ishikawa's approach, and deals with organizational aspects. It is seen as embracing all departments and functions and uses the tools which will be described in the following pages. Bendell (1989) suggests that fifteen effects arise from this approach (Box 8.1). While acknowledging that these are benefits which may arise from the approach, it cannot be agreed that they are necessarily consequent upon adopting the Company-Wide Quality Control approach. Perhaps, as Logothetis (1992: 96) suggests, 'kaizen consciousness [implied within Ishikawa's work] can only be established when management changes the corporate culture', an area which is not discussed by Ishikawa.

The use of quality circles is Ishikawa's principal method for achieving participation. They are composed of between four and twelve workers from the same area of activity and led

Box 8.1 *Fifteen effects of company-wide quality control, according to Kaoru Ishikawa (Gilbert 1992)*

Effect 1	Product quality is improved and becomes uniform; defects are reduced
Effect 2	Reliability of goods is improved
Effect 3	Cost is reduced
Effect 4	Quantity of production is increased, and it becomes possible to make rational production schedules
Effect 5	Wasteful work and rework are reduced
Effect 6	Technique is established and improved
Effect 7	Expenses for inspection and testing are reduced
Effect 8	Contracts between vendor and vendee are rationalized
Effect 9	The sales market is enlarged
Effect 10	Better relationships are established between departments
Effect 11	False data and false reports are reduced
Effect 12	Discussions are carried out more freely and democratically
Effect 13	Meetings are operated more smoothly
Effect 14	Repairs and installations of equipment and facilities are done more rationally
Effect 15	Human relations are improved

by a worker or supervisor. Their function is to 'identify local problems and recommend solutions' (Gilbert 1992: 92). Bendell (1989: 18) identifies three aims:

- To contribute to the improvement and development of the enterprise;
- To respect human relations and build a happy workshop offering job satisfaction;
- To deploy human capabilities fully and draw out infinite potential.

Gilbert (1992: 92) suggests that there are a number of 'cornerstones' to successful quality circles (Box 8.2). The first four of these factors apply to every successful quality programme: management at all levels must be committed and workers must be trained and willing participants. The 'shared work background' has some limitations, as it may fail to address cross-functional or interdepartmental needs. Solution orientation is a means of ensuring that quality circles do not simply descend into complaint sessions where the focus is on what the management, or adjacent processes, could do or not do. Considerable benefit could be gained in using Ishikawa's approach if the notion of the willing participant and how to encourage willingness had been addressed. In adversarial cultures, or where loyalty between the organization and its employees is limited, as is often the case in Western organizations, such participation is often provided very unwillingly.

Recognition of efforts is a difficult area. If there is only effort and no achievement, then should this be recognized? To maintain efforts and encourage further attempts, it is probably valuable to recognize the work done. However, the difference between effort and substantial achievement should also be acknowledged.

Minutes and an agenda provide, in essence, control devices for the circle. They enable the circle to consider what has or has not been achieved since the last meeting, to keep track of implementation of solutions and to maintain a focus within the circle on innovation rather than reiterating old points. The agenda provides the opportunity both to control the discussion once

Box 8.2 *Gilbert's 'cornerstones' to successful quality circles (Gilbert 1992)*

Top management support

Operational management support and involvement

Voluntary participation of the members

Effective training of the leader and members

Shared work background

Solution-oriented approach

Recognition of the quality circle's efforts

Having an agenda, minutes and rotating chairmanship

Keeping to the time allowed for the meeting

Informing bosses of meeting times

Making sure that quality circles are not hierarchical; if seniority plays any sort of part, you'll find the MD's [CEO's] secretary thinks he or she's too good to attend the regular secretaries' quality forum

a meeting has started and, if issued in advance, to give thinking time to the participants before the meeting to consider the issues to be raised. Keeping to time is a matter of good discipline which will be supported by the previous two items.

Informing bosses of meeting times is both courteous and good communication practice. A boss may wish to attend or to provide some input to the meeting, in the form of either ideas or implementation progress, or to support the effort in other ways.

Ensuring a non-hierarchical approach will very much depend on the culture and political issues within the organization. If an ethos of equality in problem solving has genuinely been achieved, there will be little difficulty with this aspect. However, experience of working within quality circles and other team-type environments suggests that hierarchy, of some sort, will very often emerge (Vignette 8.1).

Ishikawa suggests that quality circles should be an integral part of the quality effort, not an isolated approach. They have met with success and failure both in the West and in Japan. Bendell (1989: 19) comments that 'Even in Japan, many Quality Circles have collapsed, usually because of management's lack of interest or excessive intervention.' Both Crosby and Juran are stated to have questioned their effectiveness in the West and the experience outlined in Vignette 8.1 demonstrates some of the scope for failure. Crosby is reported to consider that quality circles are abused as a cure for poor employee motivation, productivity and quality, while Juran suggests that if an organization's management are not trained in quality, then quality circles will have limited effectiveness.

The quantitative techniques of Ishikawa's approach are referred to by Bendell as the 'seven tools of quality control' (Box 8.3). Taken together, they are a set of pictures of quality, representing in diagrammatic or chart form the quality status of the operation of the process being reviewed. Ishikawa considered that all staff should be trained in these techniques.

This chapter will examine only the Ishikawa or fishbone diagram, since this is the only technique that originated with Ishikawa. He developed the approach while at the University of Tokyo to explain relationships between factors. It subsequently became part of his quality tools portfolio and has been widely adopted throughout industry.

The Ishikawa diagram (Figure 8.1) is essentially an end- or goal-oriented picture of a problem situation. The goal or objective is placed at the head of the fish and contributing factors categorized. Gilbert (1992: 111) suggests that major categories such as 'Men, Machines, Materials and Methods' may provide a useful first set of factors. Each of these categories is then subdivided again, the 'fishbones' gaining further ribs and sub-ribs as the whole issue of concern is explored. Other forms of categorization such as processes, technology, knowledge or information systems may also be appropriate. Moreover, the approach is useful in enabling and encouraging participants to express their views.

The approach does not carry with it any automatic means of prioritization of issues, and ideas emerging are not constrained by any limitations. The pragmatic world of management, however, does impose constraints of issues such as time, technology and capital, and these may affect the value of the approach. Issues emerging which are not responded to adequately by those responsible will cause discontent, and perhaps fragmentation of the quality effort. The diagram can easily be used as a device for apportioning blame instead of one for enabling improvement.

Equally, the diagram assumes a linear, 'cause–effect' chain of events. Such an understanding of any problem is limited in that it does not address the potential for interrelationships between

VIGNETTE 8.1 QUALITY CIRCLES INACTION

In the late 1970s, a retail distributor with several hundred outlets decided to launch a service quality initiative to improve its performance in an increasingly competitive and over-supplied market. The organization, apparently committed to this initiative at its head office, selected 'quality circles' as the driving mechanism to be used at the outlet level.

The senior management of the organization at head office attended training sessions to learn the rules for quality circles, and this training was then extended to the outlet managers themselves. After some time had elapsed, all the training events had been completed and the programme was ready to be launched. Staff were informed by a letter to each outlet from the head office that the organization was to adopt quality circles as a device for improving service quality. The letter further informed them that the local manager would be arranging these events. Other than the outlet managers, no one at the local level was provided with any training whatsoever.

The local managers then called the staff together – at the end of the working day – and informed them that the first meeting of the quality circle would take place at 5 p.m. the following Wednesday. Overtime would not be paid and all staff were expected to volunteer to join the circle. At the first meeting, the rules would be explained and roles allocated within the circle.

The first meetings took place, at which the managers naturally took the role of chair and explained the purpose of the circles. The meetings were then thrown open to suggestions from the staff to improve service quality. Discussion in one outlet focused on the number of ashtrays in the customer-facing areas – were there enough, not enough, too many? Another focused, perhaps quite usefully, on the issue of opening hours, until the manager ruled the discussion 'out of order' since opening hours fell beyond the scope of the outlet to change – a constraint applied in many outlets and to many suggested discussion topics. In most cases, the manager's secretary recorded the discussion and produced minutes. The managers edited these and dispatched the edited version to head office as evidence of the meetings having taken place.

The organization persisted with these events for around twelve months, but no significant or useful ideas emerged and were implemented across the organization. No major changes took place in the organization's systems and procedures which would improve service quality to either internal or external customers. The whole exercise was essentially a waste of time although it could be argued that awareness of quality of customer service was raised among the staff, perhaps bringing some intangible benefit.

There were perhaps four major mistakes made by the organization in pursuing this quality circles initiative. First was the absolute lack of training for the staff involved. Second was the structure of the circles, with managers being appointed (or appointing themselves) as quality circle leaders, thus maintaining the hierarchy of decision. Third, the attempt to achieve participation was by unilateral dictat or coercion, quite apart from the staff not being persuaded that there was a problem to solve. Fourth was the failure by the senior management to understand the structure of the enterprise which they managed, a structure which, in effect, determined where problems could be solved. Any large retail organization adopts

standardized systems and procedures to ensure continuity and accuracy of service delivery across its outlets. Even in the 1970s, these were increasingly tied to the capabilities of centralized computer networks. The operation of these networks and their interaction with those of other organizations in the same industry controlled large parts of the customer-facing activity, dictating what it was, or was not, possible to deliver. Changes proposed to these systems were ruled 'out of order' by managers, thereby closing off any possible communication to those running the organization of the customer needs as perceived by the staff who actually dealt with those customers. What it was possible to change locally was the way in which individual staff members dealt with customers – a change which could not be created through the chosen mechanism, but only through individually focused training effort.

This was a classic case of the senior management of the organization appearing to 'blame' the staff for poor customer service, while blinding (or perhaps deafening) themselves to the potential for improvement which lay only within their own power.

Box 8.3 *Kaoru Ishikawa's seven tools of quality control*

Tool 1	Pareto charts	used to identify the principal causes of problems.
Tool 2	Ishikawa (fishbone) diagrams	Charts of cause and effect in processes.
Tool 3	Stratification	Layer charts which place each set of data successively on top of the previous one
Tool 4	Checksheets	To provide a record of quality
Tool 5	Histograms	Graphs used to display frequency of various ranges of values of a quantity.
Tool 6	Scattergraphs	Used to help determine whether there is a correlation between two factors
Tool 7	Control charts	Used as a device in statistical process control

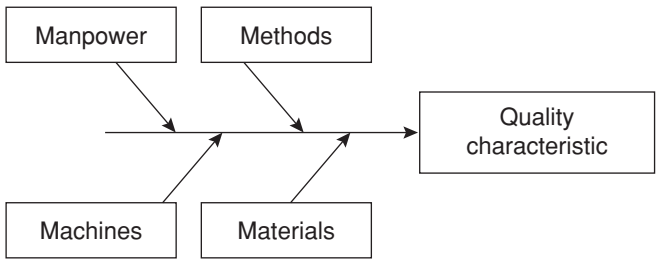

Figure 8.1 *The Ishikawa or 'fishbone' diagram*

causes, or the possibility of dynamic or time-related effects. For example, the interrelationship between workers and machines, called ergonomics, can have a substantial impact on the ability to produce a quality product or service, whereas looking at either in isolation may produce no clue as to the cause of any lack of quality. A successful 'cure' to any problem may mean making adjustments or changes in a number of places both to fix the specific problem and to ensure that the whole system remains in balance. Often, changing only one aspect can push other aspects to a point where they may fail.

To summarize Ishikawa's approach, it can be seen to contain both quantitative and qualitative aspects which, taken together, focus on achieving 'Company-Wide Quality'.

8.4 SUCCESSES AND FAILURES

Ishikawa's world-wide reputation and the widespread acceptance of his ideas suggest that his approach has met with considerable success. That he is best known for the fishbone diagram should not inhibit appreciation of the value of his other work. Similarly, that quality circles have been successful cannot be doubted, notwithstanding the level of failure that has been seen in some organizations. An organizational idea such as quality circles which has been adopted to the extent that Bendell (1989: 19) reports – 'more than 10 million circle members' in Japan alone – has undoubtedly been a successful, useful idea.

According to Flood (1993: 34–35), the strengths of Ishikawa's approach are:

- its emphasis on participation;
- the variety of quantitative and qualitative methods employed;
- its whole-system view;
- the relevance of quality control circles (QCCs) to all sectors of the economy.

Its main weaknesses can be viewed as the following:

- Fishbone diagrams are systematic but not systemic.
- QCCs depend upon management support.
- It fails to address coercive contexts.

To look first at the strengths, participation and the development of tools usable by the stakeholders are of undeniable value. They enable people at all levels in the organization to make a meaningful contribution, in their own terms, to the process of achieving quality. Promoting creativity and increasing motivation have value for both the organization and the individual.

The choice of a mixture of methods and tools which are both qualitative and quantitative encourages a broader understanding of the organization than would be achieved with a simple focus on either a single tool, or a purely qualitative or quantitative approach. The holistic perspective proposed is again supported by the current view that a systemic approach is vital in the contemporary organizational context.

While agreeing that QCCs are relevant to all economic sectors, there remain considerable reservations as to their practical value. It is rare in the West to discover an organization where more than lip-service is paid to the QCC movement. It is very often used as a device for

allowing workers to feel that they are involved but with little real commitment from managers. That is to say, the theory in practice is rarely as successful as the theory in theory!

Turning to the weaknesses, it is easy to concur with Flood's view that the 'causal chain' or linear view of problems proposed by the fishbone diagram is limited in its use. It would perhaps be better to recognize that problems are often interacting and far more complex than the fishbone approach will reveal.

The second weakness identified by Flood is the failure faced when management is not prepared to listen to the ideas emerging from quality circles, an aspect which has already been covered. In this case, the organization is probably facing the third weakness, that the approach struggles in a political or coercive context. The view that any human system is to some extent political and/or coercive has already been espoused, and a particular tendency currently prevalent in the West is that of seeking 'someone to blame'. In such a culture, genuine commitment and participation in the quality issue is unlikely to emerge since it implies acceptance of responsibility for both successes and failures. In a 'blame' culture, wholehearted participation will not easily occur since failure is met with some form of disciplinary action or punishment rather than being treated as an opportunity to learn.

8.5 CRITICAL REVIEW

There seem to be three founding elements to Ishikawa's work: an attempt at a holistic view; participation and communication through a common language; and simplicity of approach.

The first of these should be valued highly, as with the work of the other gurus. However, its use is limited by two failures. First, it does not take full account of interrelationships (the fishbone diagram tends to promote a linear view). Second, it fails to break down and work across organizational boundaries in any systemic sense, for example, QCCs are focused on a single area, or workshop, rather than being formed along interacting processes. These represent severe limitations of the approach in the contemporary context.

Participation is again highly valued, and the idea of training everybody in the same tools, language and techniques is a sound method to encourage this. However, the approach again relies rather too heavily on a willingness to participate which is often not easily found. The third strand, simplicity, is to be criticized for ignoring the complexity of and interrelationships within organizations.

The roots of Ishikawa's approach can be found in his early training and development as a chemist. Chemistry is a science which has traditionally been associated with a reductionist 'scientific method', heavily reliant on analysis and fragmentation of problems. The reductionist approach is clearly carried across into the quality sphere with the use of simple analytical tools and the 'breaking down' of processes into manageable parts.

Similarly, and as with Feigenbaum, there does not emerge from Ishikawa's work an overarching methodology which binds together and integrates all the different strands of his thinking. Thus, while many of the tools and techniques are useful in isolation, there is no clear means of implementing an 'Ishikawa' programme.

This element may itself explain, to some degree, the failure of quality circles in so many organizations. They appear to stand alone as a device for quality improvement rather than being seen as one part of a complete process of management leading towards quality improvement.

Taken in isolation, they are almost certainly doomed to failure since the changes in management attitudes and the development of a common language and a common set of problem-solving tools have not been developed to go with them.

Ishikawa appears to have taken account of developments in management thinking relating to people, what has been called the 'human relations' school, emerging in the West from the works of writers such as Mayo, Maslow and Herzberg. However, he does not seem to have given recognition to other developments, such as the emergence of the systems approaches, for example organizational cybernetics, soft systems thinking and a variety of other tools. Recognition of these approaches would have enhanced and further enriched his already substantial contribution.

Finally, recognition must again be given to the multi-dimensional approach espoused by Ishikawa. Unlike those of Deming, his methods are not predominantly quantitative (although he does use these methods widely) but incorporate a substantial qualitative element. Aspects such as attitudinal change, participation and communication are seen as vital elements in the management process.

Ishikawa's substantial contribution to the quality movement must be recognized, although the lack of a clear methodology is an obvious weakness.

SUMMARY

This chapter has outlined the principal work of Kaoru Ishikawa through the five-point critical review. Interested readers should refer to Ishikawa's own works to further develop their knowledge and understanding.

QUESTION

Quality circles are Ishikawa's principal method for achieving participation. Consider how they might function in your own organizational context.