Chapter 11

Shigeo Shingo

Admit your own mistakes openly, maybe even joyfully.
(Robert Townsend, *Further up the Organization*, 1985)

KEY LEARNING POINTS

Shigeo Shingo's definition of quality: defects in a process.

Key beliefs: defect prevention through eradication of defective processes; human fallibility; 'mechanistic' view of organizations; real-time information processing.

Principal method: Poka-Yoke (zero-defects)

INTRODUCTION

Shigeo Shingo, who died in 1990, is perhaps the least well known in the West of the Japanese quality gurus. Educated as a mechanical engineer, he became a consultant in 1945, subsequently working with a wide variety of companies in many industries. These companies included Toyota, Mitsubishi, Matsushita and Sony. During his later career, he became involved with a large number of Western organizations. Norman Bodek, president of Productivity Incorporated, in the foreword to *The Sayings of Shigeo Shingo* (Shingo, 1987), cited by Bendell (1989: 11), says, 'If I could give a Nobel Prize for exceptional contributions to world economy, prosperity and productivity, I wouldn't have much difficulty selecting a winner – Shigeo Shingo's life work has contributed to the well-being of everyone in the world.'

He is regarded by Gilbert (1992: 24) as 'one of the 20th century's greatest engineers' and he made a number of significant contributions in that area. He wrote fourteen major books, of which several have been translated into English and other European languages.

11.1 PHILOSOPHY

Shingo's early philosophy embraced the 'scientific management' ideas originated by Frederick Taylor in the early part of the twentieth century. Taylor's (1911) approach was based on what is now called the 'economic man' theory of motivation and was briefly reviewed in Chapter 4. This approach was adopted extensively by Shingo, until in his forties he became aware of the methods of statistical quality control. He adopted these methods until in the 1970s he was 'finally released from the spell of statistical quality control methods' (Bendell, 1989: 12). The breakthrough in his thinking arose when he came to believe in defect prevention. This led to his major contribution to the quality debate.

Essentially, Shingo believed that 'statistical methods detect errors too late in the manufacturing process' (Flood, 1993: 28). He suggested that instead of detecting errors, it was better to engage in preventive measures aimed at eliminating error sources. Gilbert (1992: 166) suggests that Shingo meant that we need to change our 'attitude of mind' and 'to organise and then behave in a way' which allows mistake-proofing to happen.

Thus, over time, Shingo effectively rejected the scientific management, 'economic man' theory with all its attendant difficulties, rejected control after the event, and focused on prevention. He became concerned with the total manufacturing process, and Gilbert (1992: 24) cites him as saying that 'he would prefer to be remembered for his promotion of the understanding necessary behind the concepts of looking at the total manufacturing process and the elimination of transportation, storage, lot delays and inspection'. Much of this approach has become embedded in the kanban systems, often called 'just in time'.

Shingo continued to believe in mechanizing the monitoring of error, considering that human assessment was 'inconsistent and prone to error'. He used people to identify underlying causes and produce preventive solutions. In his work, like that of Crosby, we find a clear belief, in a 'zero defects' approach. However, unlike Crosby, whose ideas emphasize worker responsibility, exhortations and slogans, Shingo emphasizes zero defects through good engineering and process investigation and rectification. Bendell (1989: 12) reports that Shingo shared the concern of Deming and Juran that 'posting defect statistics is misguided, and that instead the defective elements in operations that generate a lot of defectives should be hunted down'.

11.2 ASSUMPTIONS

The assumptions about the world that seem to underpin Shingo's approach will now be reviewed.

The first point to note is that, perhaps unsurprisingly, given his mechanical engineering background and training, Shingo can be seen to have adhered to a mechanistic approach to organization throughout his career. From engineering jobs and people in the scientific management approach of his early work, he moved to the quantitative methods of statistical quality control and, finally, to error prevention through good engineering.

The mechanistic view of organization has been challenged by many management theorists and practitioners. It has been criticized for failing to take account of human needs and desires, and for failing to recognize interactions within the organization and between the organization and its environment. Further criticisms have been aimed at the reductionist nature of the

approach, which tends to fragment organizations rather than deal with them as wholes. An approach which does not take account of these factors in an increasingly complex and dynamic world must be considered flawed.

The adoption, then abandonment, of statistical methods rests on the assumption that it is possible to develop processes which are error free. While it can be seen that in an engineering context it may be possible to achieve the zero defects objective, it is considered unlikely that the same can be done in other sectors. Food production, as was seen with Chesswood Produce (Vignette 5.1), relies on natural processes which cannot yet be engineered to achieve absolute reliability. While it is possible to improve materials and yields, the processes are still subject to forces which are outside the influence or control of the organization and its people – for example, temperature, humidity, wind, soil condition and crop diseases. Similarly, in the service sector, as previously discussed, there are many variables which cannot be controlled to the extent that Shingo's approach requires.

It has been consistently argued in this book that an appropriate balance of both qualitative and quantitative approaches is most useful. Here Shingo's assumptions must be challenged, because ignoring the human relations aspects of organization and abandoning statistical methods largely restricts the potential applications of his work to the manufacturing sector.

11.3 METHODS

It could be considered that Shingo was the first management thinker and practitioner to engage in what has recently come to be called 're-engineering' (Hammer and Champy, 1993), although the term was used as early as the 1940s in the discipline of operations research. His achievement in reducing hull assembly time from four months to two months at Mitsubishi, and the development of the SMED (Single Minute Exchange of Die) System at Toyota as part of the 'just-in-time' concept were both substantial contributions in their own right.

However, his principal contribution to the quality field is the mistake-proofing concept, Poka-Yoke, 'Defect = 0'. This approach stops the production process whenever a defect occurs, defines the cause and generates action designed to prevent recurrence. Alternatively, 'online' adjustment to the product or process may be made, enabling continuous processes to be managed. For example, in the chemical and steel industries it may be both impractical and expensive to stop a production process.

Poka-Yoke relies on a process of continuously monitoring potential sources of error. Machines used in the process are equipped with feedback instrumentation to carry out this task, as Shingo considered that human personnel are 'fallible' (Bendell, 1989: 12). People are used to trace and resolve the causes of error. Installation of the system is expected to lead over time to a position where all likely recurring errors have been eradicated.

The concept has been adopted to some extent in the food processing industry through the system known as HACCP, (Hazard Analysis Critical Control Points), which has already been outlined. Clearly, it would be unacceptable for even one defective food item to move through a system where its doing so generated risk to health. However, as is regularly seen, even such rigorous systems cannot entirely remove the risks. An example is the *E. coli* food-poisoning outbreak in Scotland during 1996, which led to several deaths.

VIGNETTE 11.1 **CYBERNETIC SYSTEMS**

The idea of Poka-Yoke is similar to the concepts employed in cybernetic systems – that is, systems which in the process of going out of control put themselves back in control again. The simplest and commonest form of cybernetic system is a domestic heating system, which on receipt of feedback information about the air temperature from the thermostat turns the heating system on and off in an attempt to maintain a set temperature. A similar example is the cooling system on an engine, where the thermostat opens and closes to allow or inhibit the flow of cold water circulation, keeping the engine at an optimum operating temperature.

The 'goal' of these systems is a particular temperature. In the case of Poka-Yoke, the goal of the system is zero defects. In each case the goal is determined outside the system, by the house occupier in the case of the heating system or the factory management in the case of a production process.

The concept is now widely employed in industrial control systems for production processes. For example, the baking industry uses a system of this type to control the chamber temperatures in travelling ovens, aiming to ensure that the product is appropriately heated at each stage of the cooking process. The employment of these techniques can reduce or eliminate the need for human monitoring of processes and, as Shingo suggests, enhance reliability.

The advances in information technology and approaches to information management make the application of these techniques much simpler. It is now possible to design and build systems which operate in real time and are capable of both detecting errors and, perhaps more importantly, anticipating errors (on the basis of the information being received) and stopping the line before the error occurs.

A common failure among organizations is not to fully appreciate what it is now possible to achieve in this regard and to stay with outmoded techniques of management. In pursuit of quality, it is useful to adopt proven, reliable techniques but it is essential to embrace those new approaches which have the latent capability to bring about substantial improvement.

11.4 SUCCESSES AND FAILURES

There is no doubt that Shingo's ideas have made a substantial contribution in a variety of areas. The adoption of all or some of his methods by companies throughout the world and his extensive consulting in many countries stand as testament to his success. It does, though, have apparent limitations.

While Gilbert (1992: 166) suggests that the Poka-Yoke concept can be applied equally to administrative procedures and production processes, this is arguable. A production process may well be fully, or extensively, automated, minimizing the opportunity for human or machine error. Administrative and book-keeping procedures, which rely for the most part on the communication and transcription of information, cannot be automated to the same extent; there is, then, scope for error. An error rate of 2 per cent (two keystrokes in one

hundred) is regarded as normal for a competent keyboard operator. Human interaction with and intervention in the system is inevitable, and, as Shingo himself said, humans are fallible. A second strand to this is the potential for misinterpretation of data. Language relies on two levels of understanding, the syntactic (signs) and the semantic (meaning). While syntactic understanding can be relatively reliably conveyed, even automated, semantic understanding cannot be guaranteed. It is not therefore possible to build an administrative system which can guarantee that the message, including its meaning, transmitted by one party is received and understood in the same way by the other party.

Flood (1993: 29) lists the main strengths of Shingo's approach:

- It offers on-line, real-time control.
- Poka-Yoke emphasizes effective control systems.

The main weaknesses are the following:

- Source inspection works effectively only in manufacturing processes.
- Shingo says little about people other than that they are fallible.

To take the first of the two strengths, there is little doubt that in a fast-moving and rapidly changing world, online real-time information is not just desirable but essential. However, the feasibility of halting many production processes is questionable.

The use of automated feedback and control mechanisms is a sound starting point for the control of a process in operation and is to be welcomed. However, Shingo says little about the management attitudes towards accountability and responsibility that must go with it. It could be argued that a management unsupportive of this approach would not implement it. Yet a technical system of this sort provides information which an autocratic management could use in a way which might be considered inappropriate: as a stick with which to beat people rather than a tool for improvement. Nonetheless, as Wiener (1948) stated in the early stages of the development of modern cybernetics, there are 'great possibilities for good or evil', and it is up to managers to use the knowledge wisely.

So far as the weaknesses are concerned, the applicability of Shingo's ideas to the service sector has already been questioned. Regarding the attitude to people, it is clear that Shingo's work assumes a willing, co-operative workforce, although he says nothing of how this state can be achieved and maintained. The body of literature concerning this topic which arose during the middle and later years of the last century has not been accounted for.

11.5 CRITICAL REVIEW

There appear to be some consistent themes to Shingo's views, despite the apparent develop-ments in his thinking, from scientific management through statistical quality control to mistake proofing.

He seems to have adhered, in the main, to an 'economic man' view of the people involved in the organization. The wisdom of this view, and his failure to address the body of theoretical and practical knowledge which challenges it, has to be considered a major weakness

of his work. While in some Eastern cultures there remains a strong allegiance to collective societary values, notably in Japan, other nations have moved away from this. Many Western countries have seen a significant move towards the pursuit of individual values and objectives, which often translates into the pursuit of individual rather than corporate benefit from work, often reinforced by the style of corporate rewards offered. In a situation where that is the case, the individual may not be willing to contribute in the way that Shingo's work suggests is necessary.

A second clear and consistent theme has been the concentration on good engineering. This is unsurprising given Shingo's background, and his contribution in this area must be considered substantial. However, it does limit the application of his ideas to organizations and processes where the concepts are most readily applied.

The concept of mistake-proofing, by refining and redesigning processes, is of great importance. While it will generally be most easily applicable in the manufacturing sector, there is little doubt that the concept, if not the practice, can be carried across into service organizations. The danger is that it may give rise to additional administrative, auditing and checking procedures, which far from reducing costs and speeding up processes may well serve to increase costs and slow down service. A second danger associated with this is that the procedures may become 'institutionalized', inhibiting or preventing adaptation and learning by the organization. Nonetheless, the underlying emphasis on prevention of error is to be welcomed.

SUMMARY

This chapter has reviewed the major contribution of Shigeo Shingo to the quality movement. Students should refer to Shingo's (1987) own work to develop and enhance their own understanding.

? QUESTION

Shingo's approach to measuring quality through technical, automated systems has been criticized for being open to abuse by autocratic managements. Consider how this problem might be overcome while preserving the value of Shingo's ideas.