Chapter 2
Quality-oriented Strategies

This chapter introduces quality-oriented strategies through the concepts of the well-known Total Quality Management (TQM). It presents its quality core perception and historical development emphasizing its underlying principles and philosophy, continuous improvement and customer/supplier quality chain, and its system-oriented approach, with the required infrastructure for supporting the improvement process. It also briefly describes Quality Organization in Japan and attempts to compare cultural/geographical styles of Quality Management (QM)—East versus West. It shows usage aspects of QM theories and practices including soft versus hard practices.

2.1 Introduction

In the worldwide changing environment of the 1980s, organizations strove for competitive advantages. In the 1970s and early 1980s, the economic advantage realized by Japanese firms through their strategic approach to quality, made firms in the Western world realize the tremendous competitive advantage of quality. It led to the *quality revolution*, the recognition of quality by top management as a 'strategic competitive edge' and to the partnership between quality and management, expressed by *Total Quality Management*.

TQM is a management practice/philosophy that emerged in the mid-1980s, as a new way of thinking aimed at achieving competitive advantages in the market place through quality improvement. It has evolved from a narrow focus on quality-oriented tools and techniques to embrace system structure and behavioral methods intended to achieve an 'overall improvement' of the organizational performances. Within TQM, the term 'quality' also includes 'time' as a universal quality characteristic of products and services. Reducing cycle time or improving productivity is another aspect of quality improvement under the auspices of TQM.

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The TQM approach to improving business performance focuses on customer needs and satisfaction, achieved with the participation of all employees.

Within the quality function itself, a stage-by-stage evolution of methods and techniques could be observed. By the 1960s, this organic development reached (in the Western world) a stage known as 'total quality control'. This stage was distinguished by breadth and functional integration as expressed by the word 'total', but still limited in scope, as imposed by the name 'quality control'. By the 1970s, the Japanese developed and practiced their special version of quality control called 'company-wide quality control'. By mid 1980s, in the Western world, the separate goals of quality and management got closer.

The operational means, which provided the binding ties between quality and management, were: (a) The quality tools and techniques used as 'universal' tools for management improvement. (b) Management's perception of the importance of time transformed into a 'universal' product quality characteristic.

The quality tools (e.g. statistical process control and cause-and-effect diagrams) were able to support company-wide improvement programs. They reached areas not directly related to quality such as sales, purchasing, invoicing, finance, products, training and service.

Time is an important characteristic of the processes involved in designing, producing and marketing products. Reducing performance time (of any kind) had high priority by management, simply because less time meant more quantity. By using a broad interpretation of product quality characteristics so that they include 'timeliness', any conflicts arising between improvement of quality and improvement of productivity (reducing performance time) are solved.

2.2 Quality Definitions

Here are some basic quality definitions.

Quality gurus (such as Juran, Deming, Feigenbaum, Crosby and Taguchi) define quality from three viewpoints: customer, producer and society. Product quality is described as 'fitness for use' (Juran 1991) or 'conformance to requirements' (Crosby 1979); it has 'to satisfy the needs of customer present and future' (Deming 1986). As seen, Deming is also concerned with the time-oriented ability of a product to perform satisfactorily. Feigenbaum's definition is more elaborate: 'the composite product and service characteristics of marketing, engineering, manufacture and maintenance, through which the product and service in use will meet the expectation by the customer' (Feigenbaum 1991). This definition is an expression of the 'total quality control concept', stressing an integrative view of quality, as reflected on other functions; also, the notion of product quality is extended to quality of service.

A different way of defining quality, providing a new way of thinking, is Taguchi's approach: 'quality is the loss imparted to the society from the time a product is shipped' (Taguchi 1986). This approach considers costs and benefits of

quality improvement projects from an overall and interactive economic view representing the 'society' (economics of producers and customers). According to Taguchi's philosophy, not investing in a prevention project likely to avoid future customer costs higher than the project investment cost will later incur a much higher loss on the producer in terms of lost market share.

2.3 Quality Development in the US (Before the Quality Revolution in the Mid-1980s)

The quality definitions above reflect the organizational development of quality over the years in different parts of the world.

The historical development of total quality management in the USA is rooted in the evolution of the quality function over the years before the management recognition of quality as a strategic competitive edge. The three main evolutionary stages are Inspection, Statistical Quality Control and Quality Assurance (Barad 1996).

Inspection

Inspection of final manufactured products is related to the development of mass production, and as such, it started before the end of the nineteenth century. It focused on conformance of production to product specifications. The goal of inspection was to separate between 'conforming' and 'non-conforming' units through sieving.

Statistical Quality Control

Statistical process control and statistical sampling procedures developed next. The goal of statistical process control is to control the quality of products during their manufacturing (on-line) and thus, (by eventually stopping of the process and its readjustment as necessary) to prevent manufacturing of non-conforming units. Commonly, process control activities were carried out under a shared responsibility of the production and the engineering departments. Statistical sampling procedures, intended to reduce inspection costs, constituted another aspect of the statistical quality control methodology.

Quality Assurance

The quality methods gradually grew into a body of knowledge comprising wider topics, such as 'quality costs', 'total quality control' and 'zero defects', known together as 'quality assurance' methods.

Quality costs represented the first formalization of the economic aspects of quality tasks. Juran introduced this topic in the first edition of his Quality Control Handbook, published in 1951. The approach trades off 'unavoidable' costs (stemming from 'appraisal' of product quality and from investments, preventing the

manufacturing of defective units, against 'failure' costs, which are considered 'avoidable'. The latter are the costs incurred by the defective units produced, some of which discovered prior to shipment to customers, causing internal failures, and others of which reach the customers, thus incurring external failures that may also result in loss of reputation. The model prescribes a cost minimizing 'optimal' quality level, as appropriate to a specific company, with lower than 100% non-defective (conforming) units, implying an 'optimal higher than zero' percentage of defective units. This 'optimal' percentage of defective units is expected to vary with the type of company, its size, type of industry and in principle it can get as low as to be expressed in terms of parts per million. This classical model used to be generally accepted, but it was in direct opposition to the theories advocating 'zero defects' as an optimal conformance level. Hence, it became controversial and was banned, although its logic was undeniable. Within TQM, there is renewed use of quality costs as an important quality economics tool.

By the 1960s, the evolution of the quality organization reached a stage known among quality practitioners and analysts as *total quality control*. This expression is from Feigenbaum's book, which appeared in 1961. It presented a first version of quality integration within a company, and its goal was to achieve quality through cross-functional coordination and collaboration. This stage was featured by breadth and functional integration, as expressed by the name 'total' but was still relatively limited in scope, as imposed by the name 'quality control'. Quality was presented as a 'system', within which the traditional (on-line) quality control activities on the shop floor were expanded (off-line) to include preparation activities such as quality design of new products and control of raw materials. Feigenbaum's pioneering principle was that quality responsibility had to be shared by all departments.

Zero Defects expressed an entirely different aspect of quality development, ultimately intended to achieve workers' participation to reducing the alarming level of defectives among the American products during the 1960s and the 1970s. The zero defects 'movement' started with Crosby's book 'Quality is Free', published in 1979, which was a great commercial success. In Crosby's view, quality is free because the cost of prevention will always be lower than the costs of appraisal (detection) and failure (correction, scrap, warranty, reputation).

Quality Assurance (QA) Systems in Israeli industries

At the beginning of the 1980s, as quality started to become an important topic in industry, we began to investigate Quality Assurance Systems in Israeli industries (Barad 1984). We selected a particular industrial area, Electric and Electronics industry because this area made use of the highest developed technologies, sensitive to quality aspects. Hence, it seemed the most promising area for the development of quality-oriented organizations and for application of quality methods. Besides the factual aspects of the survey, we were also interested in collecting and analyzing the opinions and views of managers and heads of quality assurance departments regarding the existing quality assurance systems in their companies and compare them to our evaluation of the same systems.

We choose to describe the quality assurance systems by three types of variables, representing status, structure and activities. The *status* of the quality system in the organization is an expression of the importance attributed to quality by management. The position of the quality manager and the relative size of the unit were criteria defining status. The functional capability of the unit depends on its internal organization, its *structure*. We choose to express it by the distribution of quality assurance personnel by type of jobs. A high percentage of quality personnel in testing and inspection versus a low percentage in planning and analysis indicates a system emphasizing detection and sieving of the defects rather than their elimination. The major *quality activities* in our survey were: specifications, designing inspection and testing, assurance of inspection, testing and control, quality costs, data analysis and the human factor.

The survey

The sampling population was comprised of manufacturing enterprises with 50 or more employees. Our final sample consisted in 32 companies, representing a response rate of 40%. We interviewed two people in each company, a manager (not QA) and the head of the QA unit. Besides questions covering factual data on the system, we asked both the managers and the QA heads (separately), a group of identical questions on their views regarding the activities of the QA units and on the factors likely to affect the development of the quality system.

The statistical analysis

The aim of the statistical analysis was to detect significant influences of external factors (size of company, geographical region, type of ownership, use of quantitative methods, types of final products, types of buyers, etc.) and also to find out how these factors affect one another).

The techniques we used were multiple linear regression and correlation, as well as nonparametric correlation.

Findings

1. *Findings based on factual data*
   Status: There were great variations in the relative size of the QA unit and no factor had a significant effect on the relative size. About 60% of the QA heads reported directly to the managing director. The reporting procedure was significantly affected by the percentage of products (by value) supplied to the ministry of defence or the aeronautical industry.
   Structure: About 80% of quality personnel were employed in ‘testing and inspection’.
   Major activities: ‘Assurance of Inspection testing and control’ and ‘Specifications’ were the activities which attained the highest performance level. ‘Data Analysis’ and ‘Quality costs’ had the lowest performance level. The companies whose QA heads reported directly to the managing director had a significantly higher level of activity performances.

2. *Facts versus opinions*
   We obtained two average evaluation of each activity, one based on managers and the other based on QA heads. Comparing our factual evaluations with the evaluations of these two groups, we found out that the QA heads evaluations were closer to the factual evaluations.
   We tested the measure of agreement between the two groups and obtained a significant difference of opinions about 'Assurance of Inspection testing and control' and 'Recording and reporting' which got a much lower evaluation by managers. This implies that managers considered these activities as the main tasks of QA and therefore judged them more severely. 'Data Analysis' was significantly higher evaluated by managers which means that they did not consider this activity to be an important task of QA and therefore were more lenient towards it.
   The two groups were asked to point out the three most important factors affecting (positively or negatively) the development of the QA systems. The most important positive factor according to the QA heads was 'Management Commitment', while according to managers it was 'Buyers reaction'. The two groups were in agreement regarding the two most negative factors. These were 'Lack of professional manpower' and 'Lack of cooperation among departments'.

Conclusions

Both facts and opinions implied that management commitment was the most important factor in the development and proper functioning of the quality systems. But managers were not aware enough of the economic possibilities of these systems. They acted towards their development only because of the pressure exerted upon them by strong buyers. They did not regard 'data analysis' and 'quality costs' as important quality activities. As a result, these were the most neglected activities.

2.4 Quality Organization in Japan

2.4.1 Implementation of the American Quality Methods

One of the most successful American export areas after World War II was Quality Control methods, particularly well received in Japan. Until mid-1960s, the Japanese absorbed the principles and philosophies of quality management and quality economics introduced by the well-known quality control ambassadors such as Deming, Juran and Feigenbaum. Deming presented to managers a series of seminars focusing on statistical process control.

In his well-known fourteen points, besides stressing the importance of process quality 'improvement' and the advantages of the statistical methods over mass inspection, Deming also stressed the need to preserve workers' pride and the importance of 'training' for stimulating workers' motivation to improve quality. He

considered management commitment and leadership as crucial to achieving quality improvement. Deming's cycle of improvement PDCA (Plan, Do, Check, Act) is a methodology intended to support his fundamental concept of 'continuous improvement' (see Fig. 2.1). It consists of defining the problem objectives and planning the necessary data collection (Plan), gathering the data (Do) and analyzing the results (Check). If these are all right, the next step is implementing them (Act); if not, the next step is starting anew.

Juran emphasized the necessity of a 'quality system' approach and the importance of 'managing' quality. He viewed the management role as defining quality goals, providing recognition and communicating results. He encouraged analysis of quality costs, which could offer good opportunities for improving quality. Feigenbaum brought his total quality control principles, the tools for system integration.

These gurus had some themes in common. They believed that the 'management' and the 'system' are the cause of poor quality, that 'commitment' and 'leadership' by top management are essential ingredients for successful quality programs, that quality programs need organization-wide 'long term efforts' and that '***quality precedes timeliness***'.

2.4.2 The Integrated Japanese Quality System

The total quality control methods described in Feigenbaum's book were applied in Japan by the 1970s under the name *Company-Wide Quality Control* (CWQC). This enhanced Japanese version of total quality control, is actually the first materialization of TQM.

The quality tools and techniques imported from the West were assimilated by top management and disseminated downwards. This movement did not produce satisfactory participation at the lower levels and resistance to applying the new methods occurred. The Japanese answer to the lack of work motivation at the bottom was the creation of *Quality Control circles.* These were voluntary, homogeneous small groups intended to open implementation channels for quality improvement.

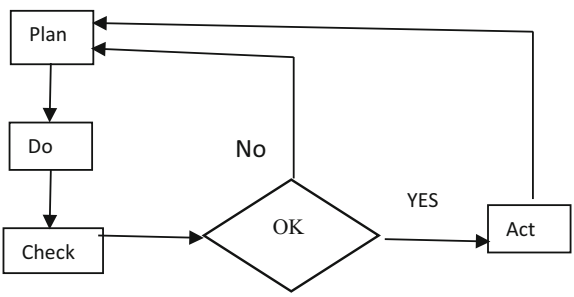

Fig. 2.1 Deming's cycle of improvement (PDCA)

Among the Japanese quality gurus who extensively contributed to this integrated approach were Kaoro Ishikawa and Genichi Taguchi. Ishikawa gathered simple graphical tools to be used by members of the Quality Control circles. *The seven basic tools* for employees participating in these improvement programs: Pareto diagrams, Flow charts, Cause and effect diagrams, Histograms, Check sheets, Scatter diagrams and Quality control charts. Deming's cycle of improvement provided the logical connections between these tools, some of which pertain to 'plan' and other to 'do', 'check' or 'act'.

Taguchi developed methods promoting the use of *Design of Experiments* to improve product and process quality by reducing variability. It was important that these methods be applied during the development stage of products and processes, the ultimate result being products exhibiting on-target and low variance quality characteristic (features that according to Taguchi's philosophy made products attractive to customers) and reduced costs. Two essential components make up Taguchi's strategy aimed at 'selling' design of experiments:

1. Providing 'economic' motivation for management to use design of experiments, in terms of a loss function expressing customers' discontent with products whose quality characteristics are not on target and/or exhibit variations.
2. Offering 'easy-to-use' instructions for implementing the methodology of design of experiments, originally an elitist western statistical method, known to statisticians and very few engineers.

Taguchi's loss function is related to the deviation of a quality characteristic from its target value. It can be expressed in terms of its variance, showing that the higher the variance, the higher the loss. Hence, reducing performance variance means reducing loss. As design of experiments is an effective tool for reducing performance variance, it is also, according to Taguchi's logic, a tool for reducing loss and attracting customers, (see also Taguchi's experimental design technique in Part II of this book).

Both types of techniques, the simple graphical techniques used by Japanese workers in quality control circles and the sophisticated design of experiments used by Japanese engineers, brought about the great quality improvement of the Japanese products and the improved efficiency of their manufacturing processes.

Figure 2.2 displays three *themes* of the integrated quality system: Main Objective, Tactics and Quality Technique. Each theme is viewed from three *perspectives*: Workers, Customers and Management. From the workers perspective the main quality system objective is achieving work motivation. From the customers perspective the product quality properties have to fit the specifications, while from the management perspective the most important objective is attracting customers and reducing costs. The workers oriented tactic is Quality Control circles, while the appropriate tactic for both customers and management is low variability of the product properties e.g. low 'loss', according to Taguchi. As mentioned above, Ishikawa supplied the workers oriented techniques within the quality control circles

(the seven basic tools) and Taguchi promoted the technique for reducing variability of quality characteristics and thus reducing loss (design of experiments).

2.5 Total Quality Strategies After the Quality Revolution—Universal Views

A corporate strategy is the pattern of decisions in a company that determine its goals, produces the policies and plans to achieve the goals, and defines the kind of economic and human organizations it intends to be. In the mid-1980s, quality as a strategy was a new idea. Traditionally, strategic 'quantity' goals always preceded 'quality' goals. As mentioned before, the recognition of quality as a strategic competitive edge by managers in the west came because of the extensive market-sharing losses to the Japanese, in the 1960s and 1970s.

2.5.1 USA—Malcolm Baldridge National Quality Award (MBNQA)

At the core of *Total Quality Management* (TQM) philosophy is Deming's pioneering concept of 'continuous improvement' (initially adopted in Japan as ***kaizen***), implying a constant change. 'Create consistency of purpose towards improvement of product and service. Adopt the new philosophy' (Deming 1986), The Deming Prize, established in Japan in 1951, defined the first and self-auditing process of quality improvement. The name TQM is related to the first American quality prize, the Malcolm Baldridge National Quality Award (MBNQA), instituted in 1987 in the USA to encourage the implementation of the same concept. It is worth mentioning that it happened 36 years after Deming prize.

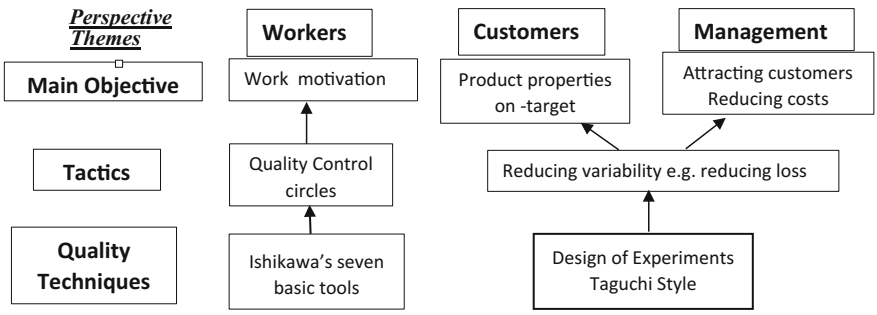

Fig. 2.2 Company-Wide Quality Control (CWQC). Reproduced from Barad (1996)

The major rationale for the creation of the Malcolm Baldridge Award was foreign competition. Realizing that customers desired high quality, the original aims of the Award were to support national efforts to improve quality and thus satisfy customers' desires. Soon it became clear that the principle of satisfying customers' desires could be applied not only to separate companies but within the same company as well. A manufacturing department is the customer of the engineering department that produces the design, whose quality has to meet the manufacturing requirements. For example, tolerances are product requirements, achieved through the designed product. In each section and department there are various series of customers and suppliers and all are part of a *quality chain*. Thus, the 'quality chain' became another fundamental concept of TQM (Barad 2002).

The tremendous impact of the Award on US and Western industry and later on global industry can be attributed to its excellent structural quality *framework*, enabling companies to assess themselves against it. The framework is a product of the National Institute of Standards and Technology (NIST).
Based on the early MBNQA framework, TQM consists in essence of:

1. Provision of high quality products/services, to satisfy customer wishes (a dynamic goal achieved through a continuous quality improvement process).
2. Achievement of high total quality in products and processes at low cost (managing process quality so as to increase productivity, get supplies collaboration and reduce waist).
3. Management of total quality through involvement of all employees, measurement of progress and communication of results.

Figure 2.3 describes MBNQA early framework (1993). It has (1) a 'driver' (top management leadership), (2) a 'system' whose elements are management of process quality, human resources, strategic quality planning and information and analysis, (3) a 'goal' focusing on customer satisfaction and market share gain and (4) measures of progress in terms of quality and operational results.

The Baldridge quality prize is awarded each year in a variety of sectors. After a few years, to reflect the evolution of the field of quality from a focus on product, service and customer quality to a broader, *strategic* focus on overall organizational quality, the name of the prize changed to *Baldridge Performance Excellence Program.* The framework evolved during the years. According to Fig. 2.4 (2016–2017), it consists in ***seven*** integrative 'critical aspects', (in some academic papers, see e.g. Samson and Terziovsky (1999) they are called 'empirical constructs') '*leadership*', '*strategy*', '*customers*', '*workforce*', '*operations*', '*results*' and '*measurement, analysis and knowledge management*'. According to the results of the much cited research paper mentioned above, only three among the empirical constructs (leadership, people management and customer focus) had a significant impact on performance.

In recent years, many of the Award recipients belonged to the health care, service, education and small business sectors.

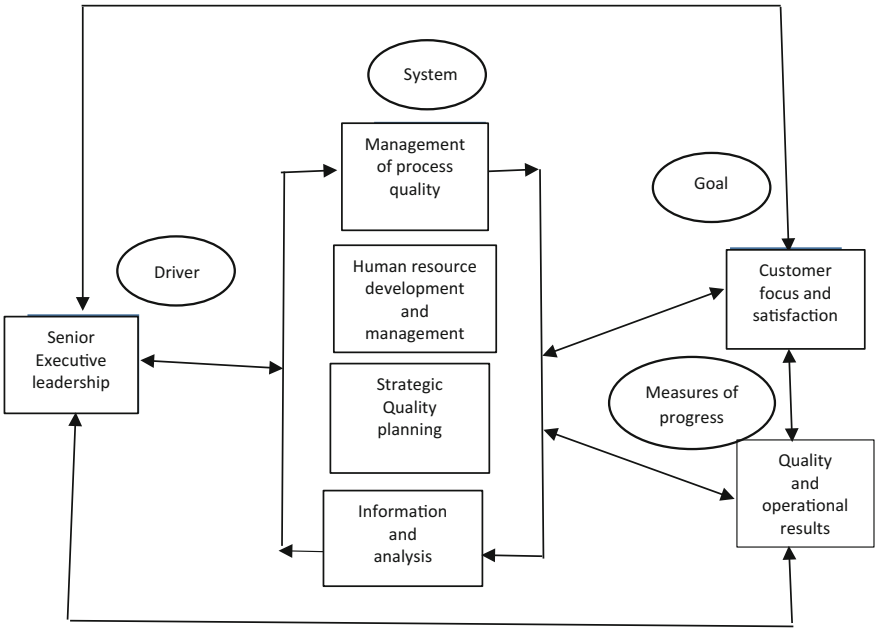

Fig. 2.3 Baldridge Award criteria framework (1993). *Source* NIST 1993: 33

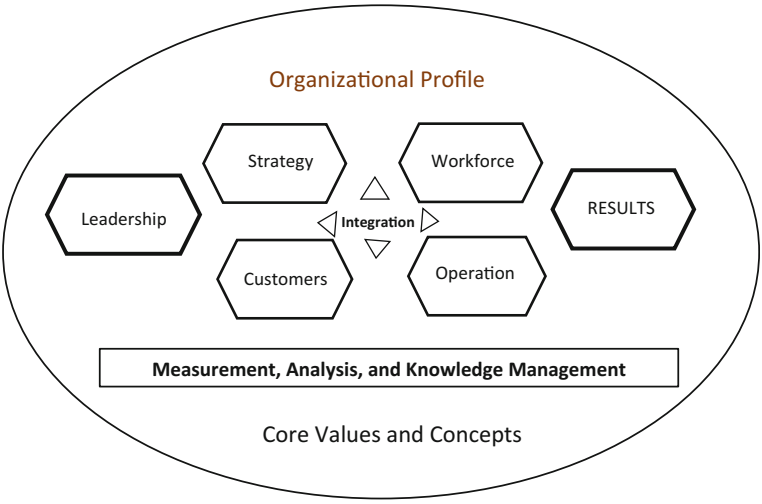

Fig. 2.4 Baldridge Performance Excellence Program (Overview 2016–2017). *Source* NIST 2016–2017

Porter's generic competitive strategies

A competitive strategy is a broad formula for how a business is going to compete (Porter 1985). There are two essential types of competitive advantages: (1) differentiation—product driven (unique and superior value to the buyer in terms of product quality and/or after sale service) and (2) lower cost—process driven. Generic quality strategies is a combination of the above two types of competitive advantages, each achieved by two types of competitive strategies: (1) Total *Quality* Management and (2) *Time* Based Management (see Fig. 2.5).

Differentiation is achieved by high product design quality and by reduced time to market. Lower costs are achieved by reduced level of non-conformance and by reduced cycle time and inventories. In contrast to the quality gurus who believed quality precedes timeliness, the TQM philosophy as expressed by MBNQA does not impose hierarchical discrimination of these two notions, Total Quality Management per se and Time Based Management (TBM). Both represent quality in the broad sense of the world. The improvement priority (product or process) is to be dynamic, i.e. determined by the most critical improvement needs of a company, at any given point in time, seen from a customer and business view.

2.5.2 *Europe*

To create a model of excellence for business across Europe, in 1991 the European Foundation for Quality Management instituted a *European Quality Award* for business (see Fig. 2.6). The model distinguished between two major types of criteria, 'results' and 'enablers' (the means to achieve results).

The results concerned 'customers' satisfaction', 'people satisfaction' (employees) and 'impact on society' (including meeting the demands of shareholders) ultimately leading to excellence in 'business results'. The enablers are five criteria: 'leadership' that drives human management, 'strategy and tactics', 'resources' and 'processes'. The results are assessed by internal (self-assessment representing pre-requisites for improvement), as well as by external assessment, comparisons with competitors and best-in-class organizations. Self-assessment enables to discover areas of improvement.

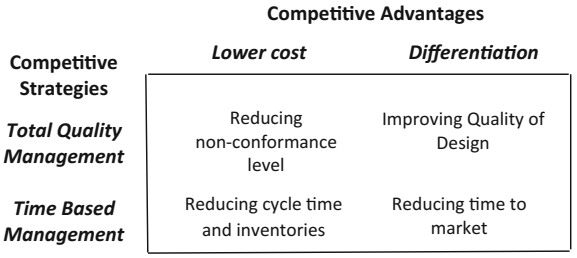

Fig. 2.5 Porter's generic competitive strategies

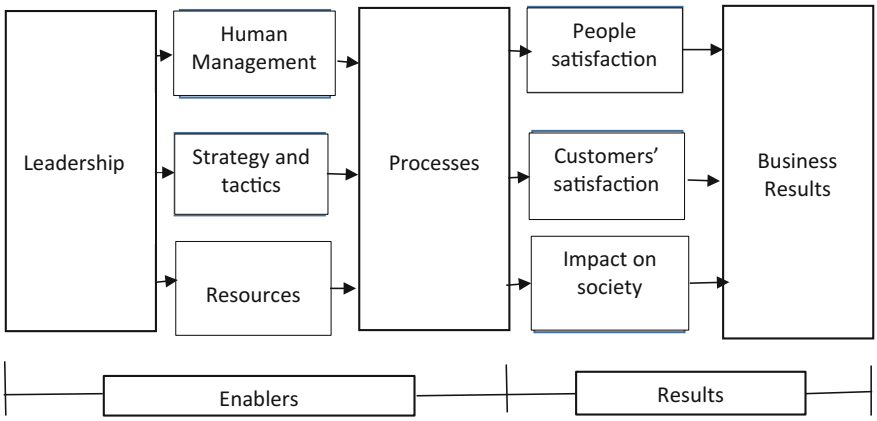

Fig. 2.6 Framework of the Quality prize in Europe (1991). *Source* European Quality Award Framework (1991)

Challenging problems for managers were how to create a 'best path' to improvement in terms of organizational structures, how to measure and communicate progress and how to achieve and sustain active participation of employees at all levels.

2.5.3 Australia

During my sabbatical at the School of Mechanical and Manufacturing Engineering, University of New South Wales (1993–1994), I worked with a young Australian colleague on a research project studying a sample of Australian companies on their way to become continuous improvement systems.

At that period, in Australia following the US example, companies became aware of the need to change their organizational orientation from a standard maintaining approach to a continuous improvement system. To that end, they could get support from the Australian *National Industry Extension Service* (NIES).

An important factor in the successful implementation of this changing process were *quality teams,* called in our project Improvement Support Systems, ISS (Barad and Kayis 1994). We modeled the team infrastructure by a three-stage sequential process with simple but systematic measures to evaluate the infrastructure elements. Stage 1: Setting the process in motion through a steering committee, basic training for managers and other employees and initiatory improvement teams. Stage 2: Monitoring and control of the teams. The challenge to management was to finding the right extent to which monitoring and control should be applied to improvement teams. Stage 3: Keeping the process alive to avoid stagnation of the improvement process. To realize that, we suggested to extend active participation of employees, systematic generation of new improvement topics (eventually through splitting and continuation of old ones) as well as by continuous upgrading of training.

The findings exposed different levels and patterns of team infrastructure. We considered a steady output flow of successfully finished projects as evidence of an active (as opposed to a stagnant) improvement system. Companies in the sample had selected a variety of topics for their improvement projects. By differentiating between time-based management (TBM) projects and TQM quality per se projects, we found that the TBM projects (such as reducing cycle time and delivery duration) constituted a majority. Focusing on these topics may represent the right decision at a certain period, but on a long-term basis, it may not be enough to keep the process alive. Quality per se improvement projects have to be undertaken on a larger scale. For these topics, more sophisticated techniques are needed and among them Design of Experiments, a technique not practiced by any of the surveyed companies.

2.5.4 *Cultural/Geographical Styles—East Versus West (China Versus Australia)*

My sabbatical in P R China (1991–1992) at the Department of Precision Machinery, University of Science and Technology of China, Hefei enabled me to have a glimpse into quality practices in P R China at that period. One year later, I continued my sabbatical in Australia at the School of Mechanical and Manufacturing Engineering, University of New South Wales and, as described above, I participated in a small-scale research on quality systems.

Culture is related to social and environmental processes and appears in different guises. Internal consistency with what human beings (such as managers and employees) may do, say and accomplish, disclose their distinctive cultural pattern, or style. We may associate cultural styles with geographical regions.

To reveal some basic cultural/geographical styles on quality strategies principles and practices, I attempted to compare my glimpse into quality practices in P R China with the evaluation of some quality practices in Australia (Barad 1995). Company Wide Quality Control (CWQC) represents a strategic approach to quality according to a Japanese style. The principles of Total Quality Management (TQM) represent the North American style strategic approach to quality. Continuous improvement is the core of all these quality strategies and like other cultural manifestations is bound to wear different forms in different countries. Whilst collaboration is an important element of any quality strategy, the way people communicate and collaborate one with the other is strongly dependent on their cultural/geographical background. Indisputable there are distinctive differences between Eastern and Western cultures.

Our basic research questions were: *Do similar marked differences also appear in the practice of quality strategies? Should we consider a distinctive 'Chinese' or 'Australian' style or rather an Eastern versus a Western quality style?*

Before describing our research, let us first discuss multi-cultural styles in quality management by comparing the two quality management pillars: USA and Japan.

Multi-cultural style in Quality Management (QM)

Examining the basic principles of TQM and CWQC, we easily arrive at the conclusion that they are similar. Both emphasize the importance of Continuous Improvement, Customer-oriented Policy, participation of all employees and deployment of these principles in all company's functions. The differences are in the extent to which each of the two famous approaches emphasizes each element. In TQM there is more emphasis in *Leadership* and less emphasis on *Education and training* in general and on quality control in particular. This point seems very significant. In CWQC theoretical knowledge on *Quality Control* (QC) and use of *statistical tools* are strongly encouraged. Tradition of education and learning seems to be more rooted in Japan as compared to the US. They are related to the high level of Japanese basic education in mathematics. This educational background enabled the Japanese managers to grasp the application potential of the theories preached by the excellent teachers who came from the Western world, where managers did not listen to statistical wisdom.

Groupism—an Eastern cultural feature

As cultural style is a universal *human* feature, it is expected to reflect a company's approach to human resources/management. 'Groupism', or collectivity orientation, is strongly mirrored in the CWQC strategy.

The QC circles can be regarded as a hybrid organization, drawing from both formal and informal elements. The pattern that makes the Japanese quite different from people from the Western part of the globe is that submission of an individual to the group decisions happens without any loss of personal dignity.

Within QC circles, the intense use of statistical methods is apparent. To enable understanding of statistical principles, simple graphical statistical tools were developed by Japanese scientists and engineers. During the 1980s, Japan promoted technology transfer. Methods of QC were successfully applied in Korea, Singapore, Thailand and Malaise. But application of QC circles was not commonly accepted in Western countries, as revealed by a large-scale study, which compared practice of QC circles in Japan and Korea versus Denmark.

Western reply to groupism—cellular organizations

In order to extend participation of employees in continuous improvement processes, 'cellular organizations' were introduced. There is not much formal theory to support these organizations, but some Western organizations adopted them successfully. They emerged as a result of several needs and principles.

First, there was the need to simplify material handling and material flow in order to shorten throughput time of parts and products. *Group technology* is an engineering concept of technical efficiency that consists of grouping physical facilities into cells. Under these conditions, it is also easier to apply a Just in time policy and thus benefit from reduced Work in Process. Secondly, according to management 'thinkers', process redesign can be combined with organizational changes, leading to a kind of 'groupism' on the shop floor. By creating 'Continuous Improvement

Cells', comprising a group of employees working in the same cell, by training and empowering them to make decisions, the active participation of employees in the improvement process could be boosted. There is a marked difference between the QC circles and cells within a cellular organization. The QC circles are practiced on a voluntary basis, while cells in a cellular organization are not voluntary but part of the system's formal organization.

Let us now return to our research, which compared some quality practices in P R China and Australia.

The survey

In P R China, the information was gathered from several visits to state-owned enterprises in Anhui Province and Beijing area in the period May–June 1992. In Australia, it was collected through a small but systematic study conducted in New South Wales in the period September 1992–January 1993. It should be mentioned that the information gathered in P R China was based on a *selective*, non-random group of industrial enterprises, while in Australia it relied on a random, stratified sample. Objective difficulties, mostly based on language barriers prevented us from applying in China the systematic methodology of the Australian study. In spite of the above differences, there was a similarity between the surveyed enterprises in China and Australia. They both formally embarked on a quality improvement program.

State enterprises in P R China receive basic information and training from the National Society of TQM. The material is disseminated top-down through hierarchical established TQM channels (Province, County). Hence, it is not surprising that the group of state enterprises in P R China in our survey exhibited some common traits, having some similarity to a Japanese style of quality management.

The small number of enterprises of the study did not enable a statistical comparison between the TQM practices in China versus Australia. Nevertheless, we noticed some distinctive differences between the surveyed companies in the two countries. The differences concerned (a) the reason for commencing the improvement program; (b) practice of QC circles; (c) quality costs reporting; (d) scope of jobs and (e) topics of improvement projects.

(a) In Australia, the commencement of TQM was motivated by product demand crisis. In China, the visited companies had as main objective product certification. In some companies, the manufacturing capacity was fully utilized. There were no such occurrences among the Australian companies, whose revenues were solely limited by product demand.
(b) In some of the Australian companies, a 100% TQM participation at the shop level was ensured through a division of the shop floor into cells (cellular organizations). We did not find such cellular organization in any of the visited Chinese companies. There, TQM participation at the shop level was only apparent through QC circles (50% average participation). By contrast, none of the Australian companies practiced QC circles.

(c) None of the Australian companies practiced quality cost reporting being thus in sharp contrast with the visited Chinese companies where reporting of quality costs was practiced on a regular basis.
(d) Broad scope jobs were encouraged in Australia, while in China we found a tendency to have narrow scope jobs.
(e) In Australia, most improvement projects had a *time-based* orientation. In China they were mostly *quality-per se* oriented.

Concluding remarks
Keeping in mind the limitations of the study, one can still draw some conclusions.

1. Distinctive differences between the way TQM was applied in China and Australia were noticed. The different organization of active employees' participation in the continuous improvement process at the shop level, namely *voluntary* QC circles in China, versus cellular organizations in Australia, can be definitely attributed to *cultural influences*.
2. In spite of the fact that in China we did not find any reference to CWQC, but only to TQM, the visited Chinese enterprises seemed to be closer to what may be called 'a Japanese style'. Evidence is provided by an over-all practice of QC circles, as well as by the early commencement of quality improvement management (1982). While no TQM principles existed in 1982, the CWQC were well established at that time. On the other hand, contrary to Japanese quality practices, which encourage quick reaction and process simplifications, the Chinese companies did not exhibit these practices. Another difference between China and other countries is the tendency of narrow scope jobs. Possibly that is dictated by its huge population.
3. The Australian improvement style looks rather similar to the North American improvement style. Its principles seemed to be rooted in the MBNQA. The reported quality improvement commencement occurred at the end of the 1980s, when TQM was already established. This may supply some circumstantial evidence.
4. Future perspectives:

   – In Australia, like in other Western countries guided by the general practices of MBNQA, based on some economic successes, they may continue to boost active participation of employees through cellular organizations.
   – China is a class by itself. What makes it special is its deeply rooted educational heritage, coupled with the natural curiosity and creative thinking of its people, its size and its socialistic regime. This factor combination makes it difficult to predict future development of TQM in P R China.
   – On a global scale, there is an exchange of cultural principles and learning on quality management. The Eastern world learned from the Western world general principles of Management, while Japan in particular also learned modern statistical theories. The Western world learned from the Eastern

world principles of teamwork collaboration. Hopefully, this exchange of cultural information will continue to enrich the quality management topic, providing a deeper understanding of the multitude and complexity of the factors involved in applying it.

2.6 Quality Management Theories and Practices—Usage Aspects

Quality is now universally accepted as a major concern for every organization. To improve quality, companies implement various Quality Management (QM) practices. Numerous quality management philosophies, methodologies, practices and tools have been designed, developed and applied. Many studies have investigated the extent and nature of their contribution to organizational performance. A main objective was to define and measure a variety of QM components. Most of the studies such as, Saraph et al. (1989), Black and Porter (1996) and Samson and Terziovsky (1999) used the MBNQA criteria and dealt with application aspects of QM in *manufacturing* and *service* industries.

In this section, we try to investigate the adaptation of global QM tools, proved effective in manufacturing and service, to additional areas such as Logistics and Project Management (Barad and Raz 2000).

Our research query was:

> Are the QM tools and practices, originally developed for the manufacturing area, fit to deal with the needs of other areas, different from manufacturing? In other words, are QM tools **generic tools?**

2.6.1 Logistics Versus Manufacturing

To address the usage aspect, we first compare the study of Ahire et al. (1996), whose data were from the *automotive* and the *manufacturing* areas, with the study carried out by Anderson et al. (1998) in *logistics*, a specific area different from manufacturing.

Ahire et al. considered questions regarding a holistic versus a piece meal implementation of the MBNQA criteria. Their study identified *twelve* QM components, and developed items to measure them. The components' list comprises: '*management commitment*', '*internal quality information usage*', '*benchmarking*', '*design QM*', '*employee empowerment*', '*employee involvement*', '*employee training*', '*supplier QM*', '*supplier performance*', '*SPC usage*', '*customer focus*', '*product quality*'.

Their findings reveal (a) the critical importance of the ***human aspect*** and its development (employee training, employee involvement and employee empowerment) relative to the other QM components. They imply that *people* are a key

element in the successful implementation of QM strategies. (b) 'Management commitment' was found to be highly correlated with the practice of customer focus, supplier QM and employee empowerment but not so highly correlated with product quality. According to the authors, this indicates that top management commitment is a necessary but not a sufficient condition for attaining superior product quality. (c) The application of practices in isolation, such as SPC and Benchmarking, was not highly correlated with product quality.

Anderson et al. collected data from members of the American Society of *Transportation* and *Logistics.* They considered ten QM components, expressing the ***seven criteria*** of the MBNQA: '*leadership*', '*information and analysis*', '*measurement*', '*training*', '*teamwork*', '*morale*', '*benchmarking*', '*supplier management*', '*operational results*' and '*customer satisfaction*'. The questionnaire design enabled assessment of QM influences on logistic performance. The data analysis intended to find a causal model of the QM component practices. The main findings were:

(a) There was no direct effect of *leadership* on operational results. The direct effect of leadership was on team and training (*human resource focus)* and on benchmarking. Information, supplier management (process management) and operational results exhibited indirect effects of leadership. (b) *Supplier management*, *training* and *information* did directly affect *operational results*. (c) Operational results as well as morale and team organization (*human resource focus)* directly affected *customer satisfaction*.

Let us now integrate the building blocks of the two studies. As mentioned above, both studies looked for linkages among input QM practices and their outcomes (operational results and customer satisfaction).

Input QM practices

There is much similarity between the input QM components/practices as defined in each study. Actually, the components in both studies reflected the ***seven*** MBNQA criteria. 'Management commitment' is similar to 'leadership' while 'internal quality information usage' is similar to 'measurement, analysis and knowledge'.

Operational results

The operational results as considered by the two studies were formulated differently. Ahire et al., who investigated a manufacturing area, only referred to 'product quality' while Anderson et al., who investigated the logistics area referred to 'operational results' from a broader perspective. These were expressed by three indicators: logistics cost performance, order cycle time and effectiveness and efficiency of transaction processes. The indicators used to express customer satisfaction were also specifically related to customer expectations in the logistics area.

We may conclude that from a generic perspective the input QM components and their indicators as defined for a manufacturing area are equivalent with those defined for logistics, thus indicating their universality. Hence, they may fit other

application areas such as project management. The operational components of the logistic research were specific to the investigated area. In the next section, we analyze quality management practices considered in a survey of project managers.

2.6.2 Contribution of QM Tools and Practices to Project Management Performance

In its Guide to the Project Management Body of Knowledge (1996), the Project Management Institute defines a project as "a temporary endeavor undertaken to create a unique product or service".

Raz and Michael (1999), carried out a survey to find out which tools and practices are associated with successful project management in general, and with effective project risk management in particular. The survey was carried out between April and June 1998. The authors gave a wide interpretation to the term 'practice', meaning special purpose tools and processes. A questionnaire, written in Hebrew, was distributed either personally or via email, to a random sample of about 400 project managers from the *software* and *high-tech* sectors in Israel. Finally, there were 84 usable completed questionnaires.

The questionnaire consisted of several parts, each containing a number of brief questions, to be answered on a 1–5 scale.

Although the main emphasis of the survey was on project risk management, two of its parts are relevant to this section. In their paper, whose title is identical with the title of this section, Barad and Raz (2000) detailed the analysis of the two relevant parts of the above questionnaire.

The first relevant part dealt with the extent of contribution of individual practices to project success in general, and included 13 Project Management (PM) generic practices. Our interpretation here of the term 'perceived contribution' is that a practice of highly perceived contribution is likely to have a high usage level. According to the findings of a pilot version of the questionnaire, the perceived contribution was highly correlated with the 'extent of use' in the organization. Hence, we will alternatively make use of 'perceived contribution' or 'usage'.

The second relevant part consisted of six questions dealing with the effectiveness and efficiency of the manner in which projects are managed in the respondent's organization and with project outcomes, such as product quality and customer satisfaction.

The data were analyzed in several steps. First, the authors assessed the *perceived* contribution of each individual practice in PM. Next, in order to assess the *actual* contribution of the practices, they calculated the coefficients of correlation between the perceived contribution of the practice, and the project management outcomes. Finally, they compared *perceived* contribution with *actual* contribution of practices.

Perceived contributions of practices

The 13 PM practices were ranked by their perceived contribution to the success of a project management. 'Simulation', 'Subcontractor management' and 'Brainstorming', were perceived as practices with the highest contribution to the success of a project management (ranks 1–3). At the bottom of the list, we find 'Cause and Effect analysis during control', 'Control of trend and deviations' and 'Training programs' (ranks 11–13).

Actual contribution

To assess the actual contribution of the practices, we looked for significant correlations between the *usage* level of a practice and the level of the *outcome variables*.

Three outcome variables evaluated the PM 'process performance' level and the other three outcome variables evaluated the 'operational outcomes' of the PM process.

The PM process performance was evaluated by C1—*extent and frequency of plan changes*; C2—*frequency of emergency meetings*; C3—*ratio of effort invested versus effort required*. C1 and C2 measure process stability, while C3 measures process efficiency.

The operational outcomes of the PM process were evaluated by C4—*satisfaction of participants including project manager*; C5—*customer satisfaction*; C6—*Product quality measured by absence of product errors.*

First, we examined the scores received by each outcome variable. Process stability, measured as plan stability (C1) received the lowest score. It was closely followed by process efficiency (C2) and then by process stability measured by frequency of emergency meetings (C3). Similarly to process stability and process efficiency, product quality (C6) was also among the low-scored outcome variables.

Customer satisfaction (C5), was scored the highest and this result is not surprising. After all, this score is an expression of the customer satisfaction as perceived by the respondent, i.e. by the project manager. The satisfaction experienced by participants including project managers (C4) was also high.

Next, we used the above outcome oriented evaluations to assess the ***actual*** contribution of the PM practices to the success of a project, by ranking them according to the number of their significant correlations with the six outcome variables, Ci, i = 1,2,…,6, as indicators of project success.

Only 8 out of 13 PM practices were highly correlated with one or more outcome variables.

T12—***Training programs***, was the practice highly correlated with all the six outcome variables and thus reached the highest rank 1. It was way ahead of all the other PM practices.

The next three practices were highly correlated with two outcome variables (ranks 2–4).

T4—*Process Control,* and T5—*Process Control Analysis* were highly correlated with plan stability (C1) and with satisfaction of participants (C4).

T13—*Customer focus* was highly correlated with satisfaction of participants (C4) and naturally, with customer satisfaction (C5).

The next four practices were highly correlated with one outcome variable (ranks 5–8).

T11—*Quality Management* and T3—*Usage of internal information* were highly correlated with customer satisfaction (C5). T7—*Benchmarking* was highly correlated with satisfaction of participants (C4), while T9—*Supplier management* was highly correlated with product quality (C6).

The remaining five practices were not significantly correlated with any outcome variable.

Thus, we obtained two sets of ranks for each generic PM practice. The first set expresses the practice contribution to a project success as '*perceived*' by the respondents. The second set expresses an '*actual*' contribution of the practice according to its strong correlations with the outcome-oriented indicators. To improve the project managers' understanding of the PM process we calculated and analyzed the discrepancies between the two sets of ranks.

We marked as 'underestimated practices', those practices whose actual rank was much higher than their rank by perceived contribution (usage) and as 'overestimated practices', those practices whose actual rank was much lower that their rank by perceived contribution (usage).

The underestimated PM practices were 'process control analysis', 'training' and 'process control' (their respective rank discrepancy: 10, 9 and 8).

The overestimated PM practices were 'simulation' and 'brainstorming' (their respective rank discrepancy: 10 and 8). It is worthwhile mentioning that the respective usage of these two (overestimated) practices was not significantly related to that of any other PM practices, i.e. they were used in isolation. This result supports Ahire et al. hypothesis that a piece meal implementation of QM practices is not likely to yield outcome results and hence it is bound to failure.

Concluding remarks

The specific findings of the survey point out to certain critical quality needs of the project management process as identified by this study:

1. Improvement of 'process control' (control of trends and deviations) and 'process control analysis' are likely to improve process stability (extent and frequency of plan changes).
2. Improvement of '***training***', whose currently reported usage was relatively low, is likely to improve all outcome-oriented variables.

The results of this study exhibit certain similarities with the findings reported in the manufacturing and logistics area. They concern:

- The importance of the human resources development (here training), on quality oriented operational results.
- The influence of management commitment (here quality management) on the practice of training and on customer focus.

– No direct effect of management commitment (leadership) on operational results.

From a methodological perspective, the analysis reported here suggests that most of the input QM components in the manufacturing and other areas such as logistics or project management are equivalent from a generic viewpoint. Accordingly, similar indicators can be used to describe them, regardless of the specific area of the empirical research. This is particularly true for 'supplier management', 'benchmarking' and 'training', which are perceived by QM researchers as universal quality oriented practices of major importance in any application area and deserve to be investigated accordingly. By contrast, 'information' and 'operational results' have to be described by indicators specific to the application area.

2.7 Soft Versus Hard Quality Management Practices

Many scientists have investigated the effect of quality management practices on a firm's performance. Recent explorations of quality management practices studied the relationships of hard versus soft factors on an organizational performance.

Rachman and Bullock (2005) carried out an empirical investigation on the effect of soft TQM and hard TQM on organizations performances. They analyzed 260 manufacturing enterprises in Australia, looking for direct and indirect impacts on performance. They suggested that **soft** TQM plays a number of roles. One is to create an environment where implementation of hard TQM can take place, and the other is to directly affect organizations performance. They considered six elements of soft TQM: *work force commitment, shared vision*, *customer focus*, *personnel training*, *use of teams* and *supplier relationships*. They suggested four elements of **hard** TQM: *Computer based technology*, *Just in Time principles*, *technology utilization* and *continuous improvement enablers* (Flexible Manufacturing Systems, Statistical Process Control and Value Added Management). They measured organizational performance by *customer satisfaction*, *employee morale*, *productivity*, *defects in percentage*, *on time delivery*, *cost of quality in percentage of sales*.

Findings

(a) Work force commitment, shared vision and supplier relationships were significantly related to Just in Time principles, technology utilization and continuous improvement enablers.
(b) Three out of four hard TQM elements (excluding computer-based technology) had significant relationships with all elements of soft TQM.
(c) Five out of six soft TQM elements (excluding training), had significant relationships with organizational performance.
(d) Use of Just in Time principles was significantly related to several measures of organizational performance (employee morale, productivity and cost of quality).

The findings suggest that in general soft TQM elements are significantly related to organizational performance.

Certain hard TQM elements also have a significant effect on performance. For hard TQM to impact performance it is essential that such hard elements be supported by elements of soft TQM.

Another paper, Gadenne and Sharma (2009), described a similar survey whose objective was to investigate the hard and soft quality management factors and their association with firm performance. The survey considered Australian Small and Medium Enterprises.

Their findings were quite similar to those of Rachman and Bullock.

They suggested that improved overall performance was favorably influenced by a combination of 'hard' QM factors and 'soft' QM factors. Their hard QM factors were benchmarking, quality measurement, continuous improvement, and efficiency improvement. Their soft QM factors consisted of top management philosophy and supplier support, employee training and increased interaction with employees and customers. The QM factors of employee training, efficiency improvement, and employee and customer involvement were important in maintaining customer satisfaction, whilst employee and customer involvement were also important in maintaining a competitive edge in terms of return on assets.

The next chapter is about ***Flexibility oriented strategies***

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