

2. From standardised product to standardised quality systems – the evolution of standardisation

2.1 Introduction

Standards and the specific forms of standardisation play a key role for the development and the function of production systems. The intention of this chapter is twofold. First, to examine the changing forms and functions of standardisation from an historical perspective and to assess how this process is related to the rise of production systems in the automotive industry. Second, to assess the driving forces of standardisation: why do standards evolve and who is responsible for setting standards. In other words what are the underlying dynamics of the process of standardisation and what role do standard setting institutions play therein.

The changing forms and functions of standards have influenced the evolution of production systems significantly: standards hold a core function in production systems. This function of standardisation within production systems is not unproblematic. The term "standardisation" is not value-free but is associated with a particular form and function of standardisation focusing primarily on its function to regulate time and motion as "Arbeitsprozessstandards: extern generiert, statisch" (Jürgens 2002:3).

The historical evolution of the forms and functions of standardisation shows that standardisation has played a far more varied role: the introduction of standardised parts and tools facilitated the American system of mass production, during Fordism, standardisation was extended to skills, training and even social standards, such as the housing and living standards Ford's workers had to conform to in order to qualify for the infamous \$5 day wage. Together with Taylorist time and motion standards, this era marked the height of standardisation. Subsequently, with the quality problems arising from mass production, the forms and functions of standardisation changed to providing quality standards. This shift also marked a gradual change in the evolution of production systems away from mass production systems towards lean, process-oriented production systems which emerged during the early 1990s and were influenced by the Total Quality Management (TQM) idea and EFQM-models. With their holistic view of quality, TQM-based systems go beyond the focus of standards contained in traditional quality management systems such as the ISO 9000. They already represent production systems in their own right because the

standards they contain no longer focus on regulating time and motions at the micro level of the shop floor but are intended to design and regulate (production) processes and outcomes. This historical overview shows that a key form and function of standardisation has been to assure the quality of products and processes, this significance is being accounted for as the evolution of standards for quality represents the key focus of the following discussion.

Of particular interest in this process is the issue of institutionalisation, specifically the role institutions play in the standard setting process. From an historical perspective, during the craft production period, guilds set skill standards. During Fordism, internal organisational units such as the Industrial Engineering departments represented the central standard setting institutions within companies. With the rise of quality standards, this responsibility shifted from companies to external standard setting organisations, such as the ISO and the DIN. As the standard setting function became located outside companies, the problem of how to control that standards are correctly applied arose. This led to the rise of certification and audit systems, and represents yet another stage in the changing form and function of standards. Also, as the case of the Mercedes-Benz production system will show, the concept of a standardised audit has been adopted for the control of the implementation of the Mercedes-Benz production system. From a social science perspective, audits function to reaffirm order and according to Power, the rapid rise and the significance attached to audits has led to the concept of "The Audit Society" (Power 1997).

The present chapter covers the following parts. In the first part, the historical analysis follows a time line tracing the evolution of standardisation exemplified by the rise of quality management systems from the pre-industrial times to the present day. Commencing with early examples of quality standards in Germany, to the role of standards affecting the quality of product, processes and work in the system of mass production in America, up to the birth of quality control standards. The spread of quality standards from quality control to quality assurance is traced following the developments in America, Japan and Germany which are the leading nations within this process.

Drawing a parallel between the institutionalisation of quality standards and production systems, in the second part of this chapter I shall examine the role of the major standard setters providing quality standards for the automotive industries in Germany

and the USA. I will also look at the influence actors from the automotive industry have on the standard setting process.

To examine in detail the forms and functions of standards in quality management systems and the influence of Japanese quality management techniques, in the third part of this chapter I shall analyse the structure and content of the ISO 9000, the VDA 6.X series, the QS 9000 and the EFQM. One part of this discussion is devoted to an examination of the role and function of audit systems.

Derived from this analysis, in the final part of this chapter I will present a cost-benefit analysis of standardisation and critically appreciate the introduction of standardised quality management systems.

2.2 Germany: the historical roots of quality standards

Before the onset of the Industrial Revolution in Germany, quality of product was associated with craftsmanship. Using stamps or marks, craftsmen provided the earliest "manufacturing guarantee for quality" (Lerner 1995:211). These marks also established the craftsmen's responsibility for their work (Juran 1995:615). Hence, up to the Middle Ages, the control over the quality of a product rested in the hands of the craftsmen. Regarding the quality goal, they were in "a state of self-control" of how to achieve it and how to "readjust the process in the event of non-conformance to the quality goal"(ibid.:618). This self-control prevailed and quality was considered as a skill which transcended through the apprenticeship in a craft (Juran 1995:554). Moreover, as craftsmen predominantly sold their goods locally, quality could be directly traced back to its origin and thus "the craftsman had a large personal stake in meeting his customers' needs for quality"(ibid.:544).

With the centralisation of power, the decline of the village and the rise of the cities, the role of the craftsmen was strengthened and new organisational structures were introduced (Ketting 1999:20). With the progress in technology and trade, but also out of fiscal interests and in driven by the craftsmen themselves, quality awareness became a dominant concern. Craftsmen founded guilds "in deren Verantwortung Massnahmen zur Konkurrenzbeschränkung und zur Ausbildung des Nachwuchses sowie vor allem zur Sicherung der Qualität (Vorschriften über Arbeitsgänge, zu verwendende Rohstoffe usw.) beschlossen wurden" (ibid.:21).

Regarding the foundations of the quality assurance system in Germany, the textile industry in particular was one of the forerunners. *The codex diplomaticus*

Brandenburgensis, a document dating back to the early thirteenth century in which the city of Berlin granted Frankfurt/Oder the right to control cloth manufacturers, explicitly stressed the importance that only previously controlled and checked material of the highest quality was to be sold (Lerner 1995:217). Inspectors, so called "Mitmeister" the forerunners of today's quality auditors, were "behördliche Sachverständige" and assessed the quality of the garment (Ketting 1999:21). At the beginning of the nineteenth century, competition particularly in the textile sector intensified as materials from Britain, France and the Netherlands entered the German market. The system of controlling the quality of garments, "once voluntarily established by their predecessors to preserve the good reputation of the trade, now became a strict law that was imposed on them during the early modern times by the town council and the patriciate, after they had fought for participation of the trades in the administration of the cities and lost" (Lerner 1995:227). This system became institutionalised as the so-called "Tuchschau". Master craftsmen proposed by the corporation of weavers were elected by the town council and thus "sworn in quality inspectors were put in office" (ibid.). Together with a number of city council members, their task was to examine the entire manufacturing process:

"This supervision started at the loom, where warps were inspected. After the cloth was taken off the loom, it was sheared and fuelled. Now the products were inspected again, to see whether they met the standard measurements for length and width. All flaws in the weave were marked with a linen hook. Only flawless products were considered perfect. According to the number of linen hooks, the imperfect cloth was divided into several groups. Faulty products were cut up and could only be sold in pieces, not as a whole, on the local market. The cloth then had to be moistened and after the drying it had to be pulled back into shape and folded according to the norm"(Lerner 1995:228ff.).

Despite being removed from today's systems of quality management and control, this early example nevertheless reflects the three particular aspects, common to all efforts to ensure the quality of products.

First, the quality of a product is seen as competitive advantage, distinguishing one product and its maker. Be it the craftsman pledging for the quality of his cloth or an

automotive manufacturer today producing a first class product, quality was and is used for marketing and is therefore part of both, the image of the product and the manufacturer.

Second, quality is not an inherent characteristic of a product, but is visually displayed by signs or marks. In other words, a sign or mark is used to indicate a particular level of quality. Whereas at the beginning, craftsmen marked their products with symbols, today adherence to specific quality standards is signalled with officially normed signs.¹

Third, quality assurance was initially part of the skills of a craftsman: craftsmanship stood for high quality. However, with the rise of guilds and trade associations, the quality was removed from the realm of production and placed into the hands of inspectors. Thus, quality control was no longer considered as part of the craftsman's job. Instead, inspectors checked the quality of products. This inspection of quality then necessitated a system of standards which would regulate how, what and when inspections were to be conducted. Indeed, these are the roots of today's complex quality audit systems.

Turning back to the historical evolution of standardisation, the Enlightenment spread the ideas of the French Revolution. A key concept was Liberalism, which intended to put an end to "antiquated customs, and liberating individuals and the economy from old chains, "cutting off old tails" (Abschneiden der alten Zöpfe)" (Lerner 1995:236). As a result, the previously "imposed systems of quality control" (ibid.) in Germany became liberalised, too, as young merchants imported the ideas of the Enlightenment from France and Great Britain (it was a custom for young German entrepreneurs and merchants to do internships in French or British companies or to go on study trips abroad).

At the same time, inventions like the steam engine revolutionised the transportation systems in Europe. This allowed markets to expand beyond their national borders, leading to an increase in product variety and diversity, but subsequently also to differences in quality levels (ibid.:237). At the same time, the establishment of the second German Reich in 1871, created a "einheitlicher Wirtschaftsraum" (DIN 1992:92). After the political turmoil which had prevailed since the French Revolution,

¹ The DIN label for example denotes the adherence of products or processes to DIN standards, the CE symbol signals that toys reflect European safety standards and do not contain chemicals harmful for children, and the DVE/GS label indicates that electrical products obey safety standards.

this caused a political stability and paved the way for reinstating "principles of order in the communities"(Lerner 1995:240).

The World Exhibitions in Paris (1867), Vienna (1873) and Philadelphia (1876) spread the reputation of German products beyond national borders and German products soon "challenged the previous British dominance of the European market" (ibid.). This sparked a fierce competition between the two nations regarding the quality, price and delivery reliability of their goods. In order to curb the influx of German and other international goods, in 1887, the British government introduced the British Merchandise Marks Act, regulating that all foreign products should be labelled according to their country of origin (ibid.). According to Lerner, the mark "Made in Germany" under which German products were now offered on the world market, soon proved to be an excellent advertisement"(ibid.).

Moreover, the consequences of this law then allowed consumers to compare products, and like in the pre-industrial era, the choice of product according to superior quality was made according to the *caveat emptor* principle (Juran 1995:604). Subsequently, craftsmen reinstated former traditions such as the apprenticeship training system, certification marks and the professional title of "master craftsman" (Lerner 1995:240). Moreover, these attempts were supported by two laws. In 1874, the "Markenschutzgesetz" (statute to protect marks) protecting the interest and rights of third parties and consumers was issued in Germany and the protectionist policies led to the ratification of the "Gesetz zum Schutz der Warenbezeichnung" (statute to protect trade marks) by the German Reichstag in 1894. In order to protect German products, the prerogative of issuing marks, once administered by craftsmen, became an institutionalised standard centrally regulated by the Patent Office of the Empire. As in the case of quality control, quality assurance was displaced from the individual to the realm of the legally enforced power. In general terms, the quality function shifted from the company-internal sphere of responsibility to the company-external, quality official or institution. This was underscored by transferring the right to issue marks of quality from the level of the individual craftsman to the level of governmental institution (Patent offices).

The early history of quality and quality standards in Germany shows that quality had been associated with the skills of craftsman and quality control was an inherent part of their job. Both economic success and reputation but also job pride were linked to product quality. However, the quality of German products was threatened as foreign

goods entered the German market. Quality standards had to be introduced to protect home consumers and products from foreign substitutes of inferior quality. Common quality standards for goods such as cloth were developed and guild inspectors, the forerunners of the modern day quality auditors, inspected and rated the quality of products. Moreover, quality as key attribute of products became enshrined through legal acts. Quality thus became increasingly a subject of standardisation as it passed from the responsibility of the craftsman, to the guild quality inspectors and subsequently became institutionalised in the legal provisions for product quality, such as trade marks and consumer protection laws.

2.3 The USA: interchangeable parts and mass production

Parallel to this process towards institutionalising quality standards in Germany, in America, the evolution of standards and standardised quality systems arose from another need: war.

As early as 1800, Eli Whitney submitted the first standardised rifles to the US government and thus put his mark on the history of standardisation as “the father of mass production for war purposes” (Dunn 1946). According to Hounshell though, Whitney merely “espoused the two principle ideas (...) interchangeability and mechanization, but never (...) understood, much less developed, its basic principles let alone its complex subtleties (...) Whitney was a publicist of mechanized, interchangeable parts manufacture, not a creator” (Hounshell 1984:31). Instead, Hounshell associates the advent of mass production with the development towards interchangeable parts, driven by the work of Simeon North’s development of standard gauges and milling machines (1816) (ibid.:29) and the first set of interchangeable rifles produced in 1827 by John Hall (ibid.:41).

The standardisation of parts or components, gauges and machines initiated in the arms industry, soon spread to other industrial sectors. Parallel to the evolution of standard gauges and parts, in 1864, W. Sellers had created the Sellers Thread, a standard for screw threads which became an American national standard in 1868 and basis of the Metric Thread adopted by the ISO in 1957. According to Baba et. al., “the standardization of screw threads dealt with only the basic standard of a thread. In order to have effective interchangeability, tolerance standards and gauge standards were also required” (Baba and Yoshiki 1997:47). The development of a gauge system subsequently enabled “interchangeable manufacturing” (ibid.:42) so

that, "Qualitätsanforderungen nunmehr aus der Herstellung immer grösserer Mengen von Gütern mit einer immer besseren, vor allem reproduzierbaren Qualität abgeleitet werden mussten" (Ketting 1999:23). However, according to Baba and Yoshiki, whereas during the craft production period, manufacturing was "relying on the experience and tacit knowledge of skilled technician, (...) with the introduction of interchangeable manufacturing, fitting can be done by an unskilled worker using limit gauges" (Baba and Yoshiki 1997:40). On the one hand, quality of products thus improved, on the other, the role of the skilled craftsmen became less important (ibid.:41).

This shift from skilled to unskilled work had been propagated previously by Adam Smith in *The Wealth of Nations* (1776) and was also reflected in the publication of Charles Babbage's *The Economy of Machinery and Manufactures* (1833). Both called for a division of labour and a reduction in job content. This would increase the repetitiveness of work which the authors considered necessary because "the constant repetition of the same process necessarily produces in the workman a degree of excellence and rapidity in his particular department, which is never possessed by a person obliged to execute many different processes" (Babbage 1833:172-3). According to Braverman, "Babbage's principle eventually becomes the underlying force governing all forms of work in a capitalist society, no matter in what setting or at what hierarchical level" (Bravermann 1974:57). It became enshrined and formalised as scientific standards of work proposed by Taylor towards the end of the nineteenth century (ibid.:61).

Taylorism led to the "systematisch-vereinfachte Organisation der Arbeit" (Ketting 199:24) and hence a sharp decline in quality caused by the "niedriges Qualifikationsniveau des produzierenden Personals" (ibid.). Moreover, Taylor's credo to split work into planning elements (mental work) and execution of work (physical work), quality in America became a concern of independent "central inspection departments" (Juran 1995:555). This destroyed the "eigentliches produktionsbegleitenden Qualitätsdenken" (Ketting 1999:24), as quality departments were responsible "die Qualität in die Produkte zu prüfen, anstatt sie zu produzieren" (ibid.). The reconciliation of Taylorism and mass production techniques with quality management was not possible because "zur Massenproduktion erforderliche Mentalität sich nicht mit der geistigen Einstellung verbinden lässt, die man haben muss, um Qualität zu ihrem Recht zu verhelfen" (Schaafsma and Willemze 1954:3).

According to Ketting, this resulted from the fact “da sich bei allen Mitarbeitern zunehmend die Meinung herausbildete, die Verantwortung für die Qualität liege in diesen speziellen Struktureinheiten” (Ketting 1999:24), outside the realm of direct work on the shopfloor.

Moreover, Juran observes that “each functional department in the company carried out its assigned function and then handed off the result to the next function in the sequence” (Juran 1995:561): a system termed “throwing it over the wall” (ibid.). With it, the responsibility for quality, too, was passed on down the line. Thus quality control was located at the end of the production process, at the end of the assembly line, where the inspectors of the quality management department, sorted the products into defect and acceptable products. This led to an enormous increase in the amount of indirect labour. Taking the example of Hawthorn Works of the Western Electric Company, in 1928, the company consisted of workforce of 40.000, of which alone 5.200 were quality inspectors. In other words, more than 20% of the workforce inspected the quality of products produced by 80% of the workforce.² This example shows that the responsibility for quality and quality awareness was lacking. Instead quality control was seen as a final filter to extract defect parts.

In addition to this decreasing quality awareness, in the wake of the results published by the Hoover report of 1921, the efficiency of the system of mass production was questioned. The Committee on Elimination of Wastage in Industry reported that the American industries were running only at 50% of their maximum economic capacity. The committee’s main recommendation was that the “industry should utilize more effectively the principles of standardization” (Dickson 1947:10). This initiated a nation wide government programme run by the Simplified Practice Division of the US States Department of Commerce. The purpose of this programme was to explore the potential of standardisation to simplify products.³ Thus standardisation became a national endeavour and results showed that by simplifying products and processes, waste reductions ranging from 24% to 98% were made (Spriegel and Landsburgh 1955:8.1ff). However, another main reason for the waste of resources was that machines and tools were unable to produce products of constant quality particularly with regard to conforming to measurement standards: “dabei zeigte sich, dass die

² By coincidence the reversal of the Pareto Principle.

³ After the World War II, the Hoover report initiated British activities to conduct similar surveys measuring and comparing the degree of standardisation in the UK and the US. The results were published by the Lemon Committee and the Anglo-American Council on Productivity in 1948. For details refer to Verman 1973:9ff., and Dickson 1949.

Mängel mit der grössten Häufigkeit nicht immer die Störungsursachen darstellten, so dass es notwendig wurde, Fehler zu klassifizieren und statistisch auszuwerten” (Ketting 1999:25).

To improve this, a statistical tool to control and analyse production processes was developed. In 1926 a team of engineers of the Bell Telephone Laboratories started experimenting with statistical control tools to improve the quality of telephone products at the Hawthorn Works of the Western Electric Company. (Juran 1995:556ff, Ketting 1999:25).

Interestingly, at the same time, Roethlisberger and Dickson (1944) examined the social and human aspects of work within the system of scientific management at the Hawthorn Works of the Western Electric Company. Their findings, stressed that “the indirect effects of technical innovation must be assessed not only in terms of fatigue and monotony but also in terms of their social consequences to the worker as a member of a social organisation” (Roethlisberger and Dickson 1944:546). Their work lay the foundation of the human relations perspective on work, treating organisations as social systems responsible for balancing both the company’s external economic position and its internal organisation consisting of the reconciliation between technical and human organisation (ibid.:552ff.). Particularly with regard to the extent of standardisation and scientific principles of work, the authors are critical as “much of this advance has gone in the name of efficiency and rationalisation. Nothing comparable to this advance has gone on in the development of skills and techniques for securing co-operation that is, for getting individuals and groups of individuals working together effectively and with satisfaction to themselves” (ibid.).

This critical view also applies with regard to the work of the Bell Engineers as their proposed early quality assurance systems were rooted in scientific methods using “probability theory to put sampling inspection on a scientific basis, and a demerits plan for evaluating outgoing quality of telephone products” (Juran 1995:556). Thus, quality management was considered an intellectual discipline in the field of mathematical statistics removed from the shop floor. The same applies also to the publication of the W.A. Shewhart’s work *Economic Control of Quality of Manufactured Product* in 1931 which marked the birth of the Statistic Process Control (SPC).

Initially, Shewhart control charts and other statistical processes were only applied by US companies (Juran 1995:557). Only America’s involvement as supplier to the Allies in World War II, “brought the urgency of national and international

standardization even more pointedly to the forefront” and standardisation “emerged as a technique of simplification for the conservation of national resources and enhancement of productive capacity” (Verman 1973:9).

Moreover, the differences between weapon and supply management between the Allies pointed at the significance of having common standards and resulted in an influx of academic activity in the areas of operations research for materials management, value analysis and various statistical methods such as linear programming to ensure the harmonisation of standards regulating the material flow. Notably, the Bell System sampling methods, or Acceptable Quality Level (AQL), were applied to the quality inspection of military goods in 1942.⁴

After the war, the War Production Board set up training programmes in order to spread the application of Statistical Quality Control (SQC) methods throughout the American civil industry. The American Society for Quality Control (ASQC) was thus set up in 1946. This initiated a wave of developing new statistical quality control tools and resulted in several changes. For example, a new job category emerged, that of the quality specialist, in companies referred to as quality control engineer. Quality assurance and control were formally institutionalised as organisational units such as the statistical quality control or quality control engineering departments.

Since the 1950s, technical innovation became an increasingly important factor for the standardisation of quality control. Particularly through the introduction of numerically controlled (NC) tools, quality assurance in the form of mechanical or automated quality control checks were introduced. According to Ketting, “Bezogen auf die Prozessqualität war es damit – aufgrund der externen Programmierung – erstmals möglich, manuelle Bedien- und Einstellfehler während des Bearbeitungsprozesses auszuschalten”, thus reducing the impact of human errors and realizing „das eigentlich originäre Qualitätskonzept, Qualität zu produzieren” (Ketting 1999:26).

Continuing the development of numerical control of machines, by the 1970s, the NC machines were replaced by Computer Numeric Controlled (CNC) machines which allowed for a direct process control, a “Qualitätsüberwachung in der Maschine”(ibid.) Whereas technological advancement regarding machines improved the control of parts, the rapid development of technologies for the military and space industry,

⁴ Their improved version was introduced in 1963 as military standards 105 (MIL-STD-105) and reached a legal status by being referenced in contracts with military suppliers, and found its way 1973 into the DIN 40 080 and in 1974 the ISO 2859 standard. For details refer to Juran 1995:558 and Ketting 1999:25.

necessitated the development of quality assurance models. The National Aeronautics and Space Administration (NASA) contributed to the development of error analysis and recognition methods such as the Failure Mode Effects Analysis (FMEA) model, first introduced in the 1960s but only twenty-five years later adopted by Ford as the Q101 (ibid.:27). Significantly, only upon being adopted by Ford as the Q101 quality guideline, was this tool introduced in the automotive industry in 1985 (ibid.).

Parallel to the spread of quality standards, consumerism and business consultancy services spread (Juran 1995:564). Consumer test services such as the American Consumer Report (the equivalent of the German Stiftung Warentest) founded in 1969, started providing independent research and comparison on the quality of goods. Moreover, bodies like the Underwriter's Laboratories, an independent, non-profit product safety testing and certification organisation commenced issuing standards for materials, it tests the manufacturers' compliance with those, and awards marks for quality compliance, so called "listing the products" (ibid.). Regarding products in the pharmaceutical, foods and food additives sector, quality became regulated by government certification through federal law. For customer complaints, ombudsmen in companies were made available or the American Better Business Bureaus (BBB) set up data banks which started recording the number of complaints lodged against a particular entity.⁵ Since the founding of the first BBB in 1912, the BBB system particularly, has proven that the majority of marketplace problems can be solved fairly through the use of voluntary self-regulation and consumer education.

During the 1960s and 1970s managers increasingly sought the help of management consultants to provide for solutions regarding the management of quality. However, these solutions were piecemeal approaches such as isolated strategies for "incentives for quality", "automated inspection and tests" and "awareness training" for staff and management (ibid.:584). According to Juran, companies lacked a comprehensive "plan of action that addressed their major quality problems" (ibid.). The 1980s saw the comprehensive reintroduction of up-to-date versions of the original statistical process controls (SPC), such as publicised in the video cassette titled *If Japan Can, Why Can't We ?* (ibid.:585). It implied that Japanese success was exclusively based on the use of statistical methods to control quality. However, merely taking the dust off old quality control measures was insufficient as companies

⁵ For more details on the issue of consumer protection see Juran 1995:563.

first had to define their particular quality goals and strategies, before considering in detail the tools how to achieve them (ibid.).

All in all, post-war strategies of American quality management, particularly during the 1980s, can be summed up as lessons learned in “what not to do” (ibid.:586). The situation changed with the publication of studies analysing the competitive advantage of Japanese manufacturers. Companies in the West suddenly became aware that their competitive advantage as quality leaders had long shrunk and that Japanese efforts, to improve and manage quality had been undertaken at a revolutionary rate. In other words, by the end of the 1980s, Juran’s prediction of 1967 had become reality:

“The Japanese are headed for world quality leadership and will attain it in the next two decades because no one else is moving there at the same pace.”
(Juran, 1967:583)

2.4 The rise of quality management in Japan

Whereas the USA laid the foundation of standards quality management systems, it was the Japanese who perfected them. Most importantly though, the history of quality management in Japan shows how quality standards contributed to the evolution of production management systems.

Similar to America, Japanese quality assurance before World War II was predominately focused on applying statistical quality tools (SQC), foremostly implemented by Ishida at the Tokyo Electric Company (ibid.:519ff.), and the application of standardised “tools, cutting and forging techniques” (Baba and Yoshiki 1997:42) imported by Tatusé Ikeda from Pratt & Whitney Co. to Sonoike Manufacturing Co. in the 1920s (ibid.).

During the occupation era, quality improvement became an immediate necessity particularly in the area of telephone communications, where the breakdown of telephone lines and services hampered the communication at the Allied General Headquarters (GHQ). Thus the Civil Communications Sections (CCS) of the Allies requested the American telephone company AT&T to send engineers to Japan to improve the quality of communication services: the door for an international exchange on quality issues between Japan and the West was opened. Notably under Sarasohn, in 1949 the CCS held management training seminars about quality

improvements for the Japanese electrical industry. The content of these seminars stressed that quality was a top management issue and not only one for the quality departments and that Japanese companies were lacking sufficient quality, cost and technical control measures. Nonaka sums up the effect of these early seminars as being “helpful in encouraging the top-level managers to get down to the business of rebuilding their companies in the aftermath of war” (Nonaka 1995:529).

In addition, according to Baba and Yoshiki, “the use of gauges spread through the Japanese industry because the US occupation army purchased large quantities of parts that had to meet their specifications” (Baba and Yoshiki 1997:51). Any parts failing to do so were rejected by the Americans. This approach was unknown in Japan, as manufacturers accepted minor quality and compensated such parts with a lower price (ibid.). In order to meet the US quality prerequisites, Japanese manufacturers had to purchase gauges facilitating standardisation of “not only the size of the parts but also the angle, parallelism, and distance between holes” (ibid.:50). An approach which until then had been resisted as Japanese manufacturers relied on the “craftsmanship on the shopfloor (...) based on rigorously trained technicians brought up under the apprentice system” (ibid.:44).

Moreover, the GHQ urged the Japanese industry to set up democratically run institutions to regulate industrial standardisation. Until then, this had been a government prerogative. In order to meet the precondition for joining the ISO, Japan set up the Japan Management Association (JMA) in 1942, The Japan Standards Association (JSA) in 1945 and The Union of Japanese Scientists and Engineers (JUSE) in 1946. Moreover, unlike Germany and the US, Japanese standards became mandatory with the introduction of the Industrial Standardisation Law 1949. This instigated the creation of the “JIS” mark, the “sign of endorsement by the government that the JIS standard was met” (ibid.:50). Moreover, “the law states the responsible government minister must examine various aspects of production by an applicant to see whether the firm has satisfactory facilities to maintain the JIS quality standard. The applicants had to receive inspections on production and inspection facilities and methods of quality control” (ibid.). In addition to the official labelling of quality, as competitive incentive, the Excellent Factories Implementation of Industrial Standardization Awards was initiated in 1951.

Historically then, in Japan standardisation and quality control were legally enforced by institutions. In addition, the achievement of quality was considered a competitive

advantage and the participation in the award competition underscored this effect, as did the Deming Prize first issued also in 1951. Two more events anchored quality management into the awareness and mind of the actors in Japanese post-war industry.

In 1950 and 1951, Dr. W. Edward Deming, trained in physics and mathematics and advisor for sampling at the US Bureau of the Consensus, gave lectures about the application of Statistical Quality Control (SQC) at the Union of Japanese Scientists and Engineers (JUSE). Dr. Shigeru Mizuno, participant of the Deming lectures recalled that “the lectures had a great historical significance for the history of quality control in Japan” (Mizuno 1984:351). The core focus was the relevance and applicability of statistical sampling and control charts to the quality control process. According to Koyanagi:

“The control chart is a tool for obtaining the most economical manufacturing methods. Look for the trouble and its explanation and try to remove the cause every time a point goes out of control.” (Koyanagi 1950:40)

First, this quote stresses the link between quality and costs. Second, the quality control process is a structured process starting with an analysis of the problem (Nonaka 1995:545). Third, with this statement Deming, underscored that quality control is a constant process of improvement. Deming’s lectures provided an impetus on Japanese quality standards of production such as striving for continuous improvement and the structured problem analysis.

Interestingly, according to Fujimoto, “the Japanese automobile industry did not play an active role when the role of total quality control emerged in the 1950s. After both Nissan and Toyota dispatched their staff to seminars on the U.S.-born method of Statistical Quality Control (SQC) in 1949, and then adopted it, both companies began emphasising capability of inspection, but the concept of company-wide quality management was not prevalent”(Fujimoto 1999:71). Instead, in the case of Toyota, the influence of Deming’s lectures sparked initiatives to adopt and develop their own tools of quality control, according to Monden then “more traditional methods of quality control have been replaced by self-inspection of all units (...) this approach to quality control is called *Jidoka* or *Autonomation*” (Monden 1993:222). This shows that with

regard to setting standards the local industry “selectively applied foreign examples to Japanese circumstances”(Baba and Yoshiki 1997:50).

The need for the development of quality tools was taken up by the lectures of Juran in 1954. Whereas, Deming had raised the significance of the tools of quality control, Juran “stressed that control charts, while necessary, were far from sufficient, and that use needed to be made of the managerial tools, requiring the understanding and co-operation of top and middle management” (Nonaka 1995:540). According to Juran, management’s responsibility for quality covers the areas of policy making, planning, control and measurement and review. Thus, Juran offered a structure for the implementation of quality control. According to Nonaka he “provided a structured approach to managing for quality and to quality improvement” (ibid.:547). After Juran’s visit, the JUSE set up courses for middle-management spreading the key points of Juran’s lectures. Indeed the course was extended to train workers and foremen via 15 minute daily slots on the radio later to be published by the national broadcasting association as an accompanying text which sold 85.000 copies. Quality control became a concern of management and worker alike. In addition to extending the training for quality, journals, such as *Total Quality Control* or *Quality Control for the Foreman*, continued to raise quality awareness (ibid.:544ff.).

Summarising this part, Japan played a key role in the history of quality management. The outsider role and the pressure of the Allies which forced Japan to find better quality solutions than America. This was particularly aided by the input of both Deming and Juran sparking off a national awareness of the significance of quality. And true to this input, the Japanese continued to refine quality standards and became self-sufficient in their management of quality. Moreover, the continuous striving for higher quality contributed to the Japanese dominance, particularly in the automotive sector and according to Ketting, “so entstand z.B., das, teilweise aus traditionellen Verhaltensweisen der Japaner sowie gleichzeitig aus grundsätzlichen Überlegungen von W.E. Deming abgeleitet, bzgl. der Anwendung in der japanischen Industrie bis in die 50er Jahre zurückverfolgbare Kaizen” (Ketting 1999:25). More specifically then, quality control “emerged through the confluence” of “the American systemic approach and the Japanese way of organising production” (Baba and Yoshiki 1997:53). The latter being characterised by a process of learning by doing derived from combining shop floor knowledge with an inherent urge for continuous improvement and flexibility.

2.5 Quality management in Germany

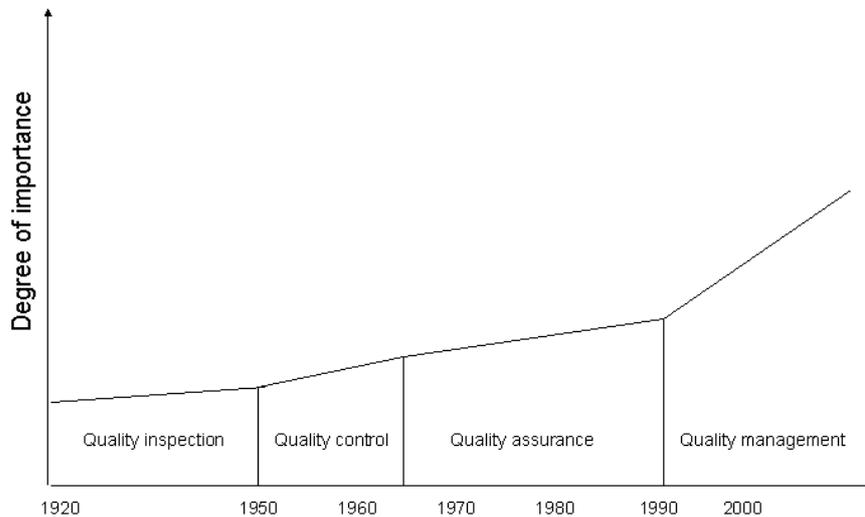


Fig. 2 – Overview: evolution of quality management based on models by Hesser and Inklaar, and Junghans.(Hesser and Inklaar 1992:Appendix Fig. 7.1, Masing 1999:5)⁶

The quality management in Germany during the twentieth century from then on evolved in four distinct stages (Hesser and Inklaar 1992:161). Commencing with the spread of mass production around 1920, quality inspections focused on the quality inspection of incoming goods, goods in process and final inspection and test. With the spread of Shewhart's statistical control charts, scientific tools and sampling methods became standardised (ibid.:162). Moreover, "durch die Erweiterung der Verfahren sowie der verbesserten technischen Möglichkeiten" quality inspection shifted to areas "im prozessnahen Bereich oder direkt im praktischen Prozess" (Ketting 1999:26). This led to a greater focus on the "Ursache-Wirkungs-Prinzipien" of potential errors necessitating "eine genauere Vorbereitung und Planung der zu prüfenden und kontrollierenden Ziele und Vorgänge" (ibid.), causing a shift in the management and overall awareness of quality. According to Ketting, "Die Tätigkeit von Qualitätskontrollorganen und zugleich auch die Entwicklung des Qualitätsverständnisses unterlag damit einem Wandel von der reinen Güteprüfung, in der ersten Hälfte des 20. Jahrhunderts, zu einer gezielten, fertigungsprozessorientierten Qualitätskontrolle und Qualitätsbewertung, bereits

⁶ see also Hesser, W., A. Inklaar, 1998:Appendix and Masing, W. (ed.) 1999:5

gegen Ende der 30er Jahre, vor allem nach Beendigung des zweiten Weltkrieges” (ibid.). This shift from quality inspection to quality control also coincided with foundation of independent national standard setting bodies responsible for regulating norms and standards such as the Normalienausschuss für Maschinenbau (Committee for Norms for Mechanical Engineering) and the Deutscher Normenausschuss (German Standards Committee) in 1926.

After World War II, quality control was considered no longer a matter associated with testing and rework but efforts focused on quality prevention. However, until 1965, these standards were predominantly “technikorientiert und methodenlastig” (Seghezzi 1998:909). The focus of quality control was on the final control, the precise definition of quality testing parameters and general orientation towards product quality (König und Hofele 1993:11). Together with the impact of American military standards, in the 1960s, the task of quality management shifted from “einer rein reaktions- und gegenwartsorientierten Qualitätskontrolle auf eine präventative und in die Zukunft gerichtete, methodenintegrierte und systematische Qualitätsplanung und –sicherung” (Ketting 1999:26). Quality control evolved into quality assurance and the focus on developing preventative measures to assure quality in technical and planning areas (König und Hofele 1993:11). Furthermore, a process orientation of quality management was already evident, insofar as quality tests for products were perceived to be no longer adequate, “man verlangte die Beherrschung der gesamten Prozesskette vom Lieferanten bis zum Kunden” (Seghezzi 1998:909). With this extension beyond internal quality assurance, companies increasingly perceived the need to provide resources for quality management. This shift is visualised in Masing’s model of the relation between product and process quality.

The model links the functions of quality management systems and production systems, as it points out the link between work regulations and task performance as major inputs determining process quality, as shown below:

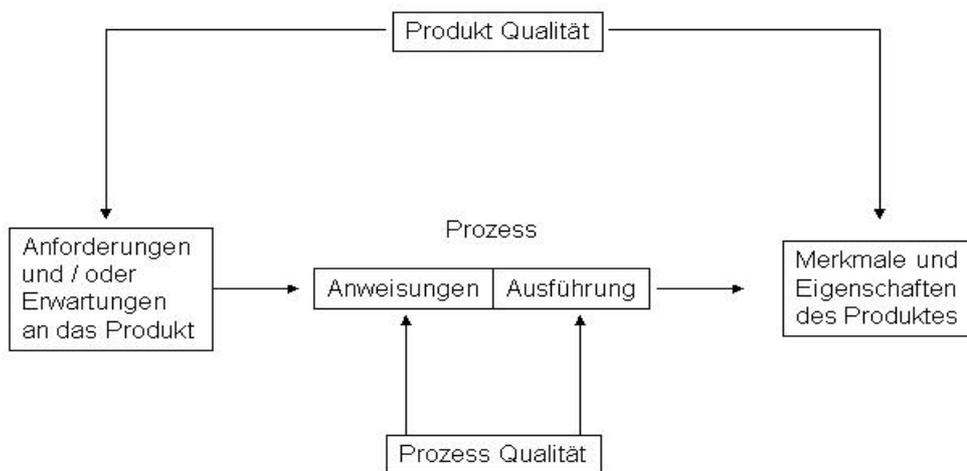


Fig. 3 - Masing model of product and process quality (Masing 1999:9)

The quality of the product is reflected in both: customer expectations and demands in relation to the product and product specific characteristics (specifications), whereby the former provides the input into the production and quality process, the latter representing the result of it. "Anweisungen" or regulations determining how tasks are to be conducted are derived from the particular needs the product has to fulfil and are subsequently executed. According to Masing, "jede einzelne Tätigkeit muss bestimmte Forderungen erfüllen, sie haben die Form von Anweisungen" (Masing 1999:9). Both work regulations and task performance are in turn subject to the quality control of the entire process and "das Mass der Übereinstimmung von Anweisung und Ausführung definiert die Qualität der betreffenden Tätigkeit. Damit wird Qualität intern vorgegeben, messbar und analysierbar" (ibid.). Hence, both work regulations and work performance are controlled and checked in terms of their contribution to the overall quality of the product. According to Masing then, "wenn die Prozessqualität gut ist, muss die Produktqualität es auch sein, vorausgesetzt, die Anweisung entspricht der Forderung des Kunden" (ibid.). A formalised framework for the evaluation of both product quality and process quality was therefore necessary and led to the introduction of the ISO 9000 quality management standards, discussed in due course.

Summarising this first part of the chapter, as seen in the case of Germany, during the pre-industrial era, quality had been part of the responsibilities of craftsmen and quality awareness was ingrained in the cultural consciousness of craftsmen and workers. However, through the introduction of specific quality controls, the responsibility for controlling quality shifted from craftsmen into the hands of guilds, professional trade organisations or town councils.

The origins of standardised quality management systems are in America. At the brink of industrialisation, during the early nineteenth century, in America the function of standardisation was to ensure the production of replaceable parts for the military. Thus standardisation spread from jigs, gauges to parts and work itself. With the advent of mass production, product quality suffered thus necessitating the development of standardised quality control tools. These were at first based on statistical methods, but gradually the rise of new technologies integrated mechanical quality control tools into machines and processes. The history of quality standards thus spread from quality inspection, to quality control, to quality assurance until today, quality management systems aim to ensure stable quality of products and processes.

Deming and Juran exported western standard quality control tools to Japan. Combining statistical quality standards with an awareness to constantly improve quality standards, the quality function changed. Instead of detecting quality errors in finished products, standards were developed to pre-empt any potential error to occur during the process: quality control evolved into quality assurance. Moreover, the Japanese integrated the American systematic approach towards quality control and assurance into their own production organisation. In my opinion this marked an important step: instead of merely assuring quality, by subjecting quality to the process of constant improvement, quality management became an integral part within the overall organisation of Japanese production systems. In the case of the Toyota Production System, for example, this is evident as quality assurance is considered a major sub-goal of the production system. Furthermore, workers are encouraged to continuously improve processes and standards not only to reduce waste, but also to improve the quality of the product (Monden 1993:3). Quality management has thus become a fixed ingredient of Japanese production systems.

Acknowledging the role of Deming and Juran as individuals contributing to the evolution of quality management, the history of standardisation and quality management is incomplete without looking at the key institutions which were founded along the historical path helping to institutionalise, formalise and develop standardisation. The purpose of the following part is therefore to take a closer look at their role in this process.

2.6 The historical rise of standard setting institutions

The second part of this chapter presents an overview of the role and function of the main standard setting institutions in Germany, the USA, Europe and internationally. I shall start by comparing the responsibilities of national standard setting bodies in Germany and the USA and what role professional associations of the automotive industry play in the national standard setting process. In the next step I will consider the international level of standard setters, primarily focusing on the function of the International Standards Organisation (ISO).

2.6.1 National standards setting bodies (NSBs)

National standards organisations (NSBs) are responsible for the co-ordination of company and industry level standards and their reconciliation with international standards (Verman 1973:104). Moreover, the “development of standards and technical rules by institutions given authority to do so by both the private and public sectors, is an essential element of the technological and economic infrastructure of a nation, and greatly influences its competitive ability and the strategies of companies” (DIN 2000:6).

These national standard setters consist of either organisations, institutions, institutes, associations or societies. In non-centrally run states they are independent non-governmental bodies. For example, as National Standards Bodies (NSBs), the Deutsches Institut der Normierung (DIN) and the ANSI (American National Standards Institute) are members of the International Standards Organisation (ISO) but are responsible for their particular “national orbit” (Verman 1973:105). The DIN is privately run, its standards are voluntary and it published by far the greatest number of standards, current figures published in the annual report of the DIN (2002) show that since its beginning, the DIN has published 26.000 standards, 2.000 alone

between 2001 and 2002 (source: DIN 22.01.02)⁷. Moreover, it conducts research and publishes periodicals on the issue of standardisation and also offers a standards certification scheme.

The DIN and the ANSI have traditionally been issuing technical standards. However, with the spread of quality standards, they have increasingly been responsible for issuing national standards on quality management systems such as the DIN:ISO series. To understand this development, a closer look at the history of both standards setting bodies is useful.

2.6.1.1 Deutsches Institut der Normierung (DIN)

In 1895 the *Verband deutscher Elektrotechniker* was founded to regulate energy safety measures. The first German standards then consisted of "Normen über Materialeigenschaften, Materialklassifikationen und Prüfverfahren" of raw materials such as iron and steel (DIN 1992:94). However, this early attempt of setting electrical standards remained exemplary. In December 1916, driven by the need to simplify arms during the war, the *Königliches Fabrikationsbüro für Infanterie und Artillerie (Fabo I & Fabo A)* was set up in an old gym in Berlin Spandau. The production process of weapons involved a number of companies. However, "Massnormen für Konstruktionsteile, wie Keile, Nieten, Schrauben und Zahnräder" were not standardised (ibid.:96). Indeed, the "Vielfalt der vorhandenen Systeme auf Werksebene stellte sich nun als hinderlich heraus" (ibid.). It was therefore the task of the Fabo to provide national standards harmonising these "Passnormen" (ibid.). The benefits of the rationalisation of parts resulting from the standardisation activities of the Fabo soon convinced other manufacturers. In order to provide standards improving war time production, together with representatives of the Fabo, the Association of German Engineers, and the German industry, the *Normalienausschuss des deutschen Maschinenbaus* was founded in May 1917 (ibid.:98). Recognising a need for standardisation after the war, in December 1917 the Deutsches Institut der Normierung (DIN) was set up. The first standards, DIN Norms 1–5, regulating drawings for "Kegelstifte, Normaldurchmesser, Normalblattformate und technische Zeichnungen" were issued in spring the following year (ibid.:99).

⁷ A large number, compared to a total of 14.650 standards issued of the American counterpart of the DIN, the American National Standards Institute by 1999.

During the reconstruction period after World War II, the DIN standards became enforced law, particularly in areas where the Allied bombing had destroyed complete infrastructures. For example, in October 1945, the Berlin magistrates made DIN standards mandatory for the city and thus "Normen für Fenster, Leitungsrohre, Klempnerwerkzeuge, Heizungsöfen und Badewannen wurden aufgestellt" (ibid.:114). Today, the role of the DIN is "the principal regulatory body for technical rules" in Germany (ibid.:8). It represents Germany at the European Committee of Normation (CEN) and the International Standardisation Organisation (ISO). Based on the DIN 820, the task of the DIN is to provide standards insofar that they concern a "Vereinheitlichung von materiellen und immateriellen Gegenständen zum Nutzen der Allgemeinheit" (DIN Norm 820 1994:1).

According to the DIN, the object of their work is to research and propose standards aiming to relieve German law giving bodies, particularly with focus on providing standards for the "Sicherheit von Menschen und Sachen und dem Umweltschutz in allen Lebensbereichen. Sie dient einer sinnvollen Ordnung und der fehlerfreien Verständigung" (ibid.). Standardisation is thus seen to promote "Rationalisierung und die Qualitätssicherung im privaten Lebensbereich wie in Wirtschaft, Technik, Wissenschaft und Verwaltung" (ibid.). In 2001 the work of the DIN was conducted in 83 Standards Committees, Technical Committees of Standards Committees (working groups of Standards Committees) 4.182 working groups, advised by 24.963 external experts and supported by a total DIN staff of 702 (DIN annual report/joint report of the president and director of the DIN 2001), brought together from a diverse background of representatives of "the manufacturing industries and commerce, consumers, interested parties within the trades, service companies, science and research, technical supervisor bodies, employers, trade unions, public agencies" (DIN 1992:8). DIN standards are first and foremost considered to represent voluntary recommendations "für ein einwandfreies technisches Verhalten im Regelfall" (ibid.:11). All standards are considered common property and are thus accessible for the general public (DIN Norm 820 1994:2). Their core aim is to harmonise standards for the "Erfordernisse der Allgemeinheit" (ibid.). Moreover, standards are to be revised every five years according to the DIN the regular updates serve to ensure that standards reflect the "jeweiliger Stand der Wissenschaft und Technik sowie die wirtschaftlichen Grundlagen" (ibid.:3). Considering the rapid changes particularly in the field of information technology, a five year period is rather long and it is doubtful if

standards thus reflect the up-to-date level of advancement. To account for these rapid technological changes, the DIN has set up special project groups (Projekte zur Entwicklungsbegleitenden Normung, EBN), which keep a constant update of the evolution of new key technologies (for example, laser technology, robotics, telecommunication and artificial intelligence) and develop standards alongside their evolution (DIN 1992:74).

Once the need for a standard is recognised, it is drafted and its ratification is based on a consensus decision keeping in mind that "nur das unbedingt Notwendige wird genormt. Normung ist kein Selbstzweck" (Petrick and Riehlen 1999:77, Kortzfleisch 1967:333). However, the question regarding what is necessary, shows that there are actually no limits to what may be standardised within the technical discipline.

Finally, the DIN considers its work also in an international context, thus proposing that German standards are not insular solutions but have to function in an international context. Regarding the increasing globalisation of the German industry, this principle is particularly relevant. Indeed, already during the 1920s, the importance of an international harmonisation of standards was recognised as an essential prerequisite for the trade between countries particularly regarding the standardization of products, quality standards and quality tests. The DIN is therefore representing Germany at the International Standards Organisation (ISO).

So far then, the DIN has been seen to provide general quality management standards. The question is though, to what extent do standards incorporate the specific needs of the automotive industry and what influence do actors of professional automotive institutions have on national standards ?

The interests of the automotive industry at the national standard setting level is represented by the Fachnormenausschuss „Kraftfahrzeugindustrie" (FAKRA) of the DIN. Its origins date back to the roots of the DIN, insofar as World War I necessitated the development of standards for replaceable parts such as tires, wheels and spark plugs. Before the founding of the FAKRA in 1925, this had been the task of the "Verkehrstechnische Prüfungskommission" (VPK). The blue FAKRA handbook first issued a collection of standards which had been suggested by experts from the automotive industry and finalised by the FAKRA (DIN Normenpraxis 2002:1). Based on the link between industry experts and standard setting institutions, the automotive manufacturers directly contribute their expert knowledge to the standardisation process.

After World War II, the work of the FAKRA focused on developing standards in four main areas: "Massnormen, Verkehrssicherheit von Kraftfahrzeugen, Technische Ausgestaltung, Konstruktions- und Prüfnormen" (ibid.:1). The assurance of international compatibility particularly with regard to mechanical parts, brake systems and electrical equipment was as important as developing standards regarding the testing of noise and emissions. The FAKRA then provides standards regarding product specifications at the functional level of standardisation and that it operates in association with the Verein Deutscher Automobilhersteller (VDA). As "Dachverband" (umbrella organization) of the German automotive sector, the VDA itself is a mediator between political institutions and the automotive industry, the VDA considers itself as service provider of statistical data on the automotive industry, registration figures, data and surveys on the German automotive industry rather than as a bureaucratic organisation. Unlike the FAKRA, the VDA functions as the representative body of the German automotive industry, and thus does not issue standards.⁸ However, through its co-operation with the FAKRA, the VDA provides a direct channel for the automotive industry to take part in the process of setting standards and specifications for the automotive industry.⁹

Regarding the international dimension, the FAKRA represents the DIN in specialist automotive committees of both the ISO and the CEN. Regarding the former, the FAKRA represents the German automotive industry in the technical committee (TC) of the ISO, (ISO/TC 22 responsible for international standards for road vehicles, and ISO/TC 104 and 204).

At European level, the FAKRA represents Germany at the Comité Européen de Normalisation (CEN). "Although the standardization culture of the automobile industry is mainly linked to ISO, there are applications, which are, for specific niche markets or legislative environment reasons, developed within European standardization" (CEN 2002:1), this applies, for example, concerning the development of standards for electrically propelled vehicles or fuel cell cars. To develop standards for these new technologies in the automotive industry, the CEN has set up specific technical committees which the FAKRA attends (CEN/TC 301, 278 and 119).

⁸ The standard setting function of the VDA is limited to its Quality Management Centre (QMC), a division of the VDA set up in 1997, responsible for setting a issuing the VDA 6.X series of automotive standards, a topic which will be examined in detail below.

⁹ The VDA represents Germany at European level at the Association des Constructeurs Européens d'Automobiles (European Automobile Manufacturers Association) in Brussels.

To sum up this part, the DIN represents the major national standard setting body in Germany. The interests of the automotive industry, as well as other industries, are represented in specifically set up committees. Thus professional bodies co-operate with national standard setting bodies, as is the case between the FAKRA and the VDA. Regarding the responsibilities, the FAKRA sets standards for products or technical specifications of the automotive industry. It also liaises with international counterparts at both European and international level. This shows that the automotive industry in Germany is integrated into the national and international standard setting process.

2.6.1.2 The American National Standards Institute (ANSI)

Like its German counterpart, the American National Standards Institute (ANSI) (founded in 1918) is a private, non-profit organisation providing the official forum for the development of "consensus agreements on technical, political and policy issues" (ANSI 2002b:2). The role of the American standards institution is influenced by the historical development of standardisation. As discussed above, quality standards originated within Europe. This strong tradition continues as the dominance of the standard setting institutions is still located within Europe: there are influential National Standards Setting Bodies (NSBs), like the DIN in Berlin, the European standard setting institute (CEN) in Brussels, and the International Standards Institute (ISO) in Geneva. The ANSI particularly fears this European influence. Indeed, the European standard setting bodies are considered to pursue a strategy of "aggressively and successfully promoting its technology practices to other nations around the world through its own standards processes and through its national representation" (ANSI 2002a:3). The participation of the ANSI at international standard setting level is then not only a matter of representation but an attempt to counteract the European dominance over the setting of international standards.

Regarding the function of the ANSI in America, it is important to point out that it neither issues standards nor tests or evaluates products or services itself. Instead, the ANSI "accredits qualified organisations to develop standards" (ANSI 2002b:6) and hence is more of an accreditation agency, than a standard setting institution. Part of this agency function of the ANSI is to regularly audit its accredited organisations. Currently, there are 250 accredited ANSI entities, but the total membership of the ANSI consists of around 1000 national and international

companies, 30 government agencies, and more than 270 professional, educational, technical, trade, labour and consumer organisations (ibid.:21). Thus the work of the ANSI is limited to providing administrative support and serves as an “oversight body to the standards development and conformity programs and processes” (ibid.:6). In other words, instead of issuing standards, the ANSI provides standards on how to set standards and “designs processes for generating standards” (Knieps 1995:290) thus standardising the standard setting process. This allows each industrial sector to develop standards through a predefined standardised process. If accepted, the ANSI issues this industry standard as an American National Standard (ANS).

In the case of the automotive industry, standards are for example developed by the counterpart of the VDA, the Alliance of Automobile Manufacturers (AAM) founded in 1999.¹⁰ It consists of all international automotive manufactures with manufacturing sites in the USA, including for example the BMW Group, DaimlerChrysler Corporation and Toyota Motor North America. Thus the “Alliance member companies have approximately 600.000 employees in the United States, with more than 250 facilities in 35 states. Alliance members represent more than 90 percent of U.S. vehicle sales” (AAM 2002:1). The standards set at this industry level are “so well developed that the standards issued by most industry associations are generally considered (...) as standards of national importance and used as such” (Verman 1973:99). Thus, development of national standards takes place at industrial level “under the auspices of the ANSI and in accordance with the latter’s formal procedure” (ibid.).

The advantage of this sectoral focus is that standards are created from within the industry, thus embodying the specific expertise and experience in the particular industry. The understanding that “no single standardization system can satisfy all needs” (ANSI 2002a:6) ensures that standards are appropriate to the actual problems of the industry sector thus providing for consensus decisions upon which the voluntary American system of standardisation is based. As with German standards, upon adopting or legally referencing ANSI standards, these in turn become mandatory. Moreover, like their German counterpart, in co-operation with the ANSI, standard developers and the US government are encouraged to set up

¹⁰ Unlike the close connection between the VDA and its QMC standard setting body, there is a less formal link between the AAM and the Automotive Industry Action Group (AIAG), responsible for issuing the QS9000 standards (the US equivalent of the German VDA 6.1 standards issued by the VDA/QMC). For a detailed discussion of the AIAG’s work and the QS 9000 refer to the second part of this chapter.

education programmes particularly for promoting the “benefits of strategic standardization” (ANSI 2002b.:20).

Overall then, the difference between the DIN and the ANSI, is that the DIN is actively involved in the standards setting process, the ANSI provides the administrative framework for the implementation of standards but delegates the development of quality standard to accredited organisations. The advantage this approach ensures is that standards provide the most appropriate solution for the specific needs to each industrial sector. The interesting question resulting is, how can these different approaches be reconciled on an international level ? To assess this question a closer look at the ISO provides useful input.

2.6.2 Institutionalisation of international standards – the International Standards Organization (ISO)

At the turn of the century, the discovery and wide-spread assimilation of electricity led to the creation of the International Electrotechnical Commission (IEC), considered the “premier international authority” (Verman 1973:151) setting standards for the electrical and electronics industries. However, attempts at creating one world-wide standard setting institution took almost another twenty years. In 1921, Belgium, Canada, the Netherlands, Norway, Switzerland, UK and USA agreed on exchanging information regarding their respective national standards. In 1926 the formal foundation for the International Federation of the National Standardizing Association (ISA) was laid by 14 countries including Germany, the USA and Japan. Between 1942 to 1947 the activities of the ISA were temporarily taken up by the United Nations Standards Coordinating Committee (NSCC). In October 1946, the constitution and rules of the International Organisation for Standardization were ratified by all members of the NSCC and the ISO started its activities in 1947. Aiming to harmonise already existing international standard setting bodies, as stated above, the International Electrotechnical Commission (IEC) was integrated into the ISO. Incorporated as the ISO’s Electrical Division, the IEC nevertheless retained its independent status and identity. The function of the ISO is to draft international standards based on the individual contributions by its national members. In other words:

“The existence of non-harmonized standards for similar technologies in different countries or regions can contribute to so-called "technical barriers to trade". Export-minded industries have long sensed the need to agree on world standards to help rationalise the international trading process. This was the origin of the establishment of ISO.” (ISO 2002a:2)

However, parallel to the growing number of nations taking part in the ISO activities, the subject of standardisation was extended from providing functional standards to providing performance standards. Notably, the widespread use of the ISO 9000 series of standards proposing the specific criteria necessary for the management of quality, has reflected this development.

During the 1980s, the need to provide standards for global quality management systems became evident and the answer was seen in the introduction of the ISO 9000, a set of international quality management standards, issued for the first time in 1987.

The role of the ISO has mirrored the evolution of standardised quality systems. Whereas at first, the focus was on integrating technical standards into international standards, the responsibility of the ISO has increasingly shifted towards providing international standards for managing the quality of processes. The development of the ISO 9000 series has been a milestone for the ISO in this respect. To analyse this further, in the following section I shall examine the rise of international and national standards for quality management: the ISO 9000 series, the ISO/TS 16949, the VDA 6.X series, the QS 9000 and the European Federation of Quality Management Model (the EFQM model).

2.7 The institutionalisation of international standards for quality systems – the case of the ISO 9001 series, the VDA 6.X, the QS 9000 and the EFQM model

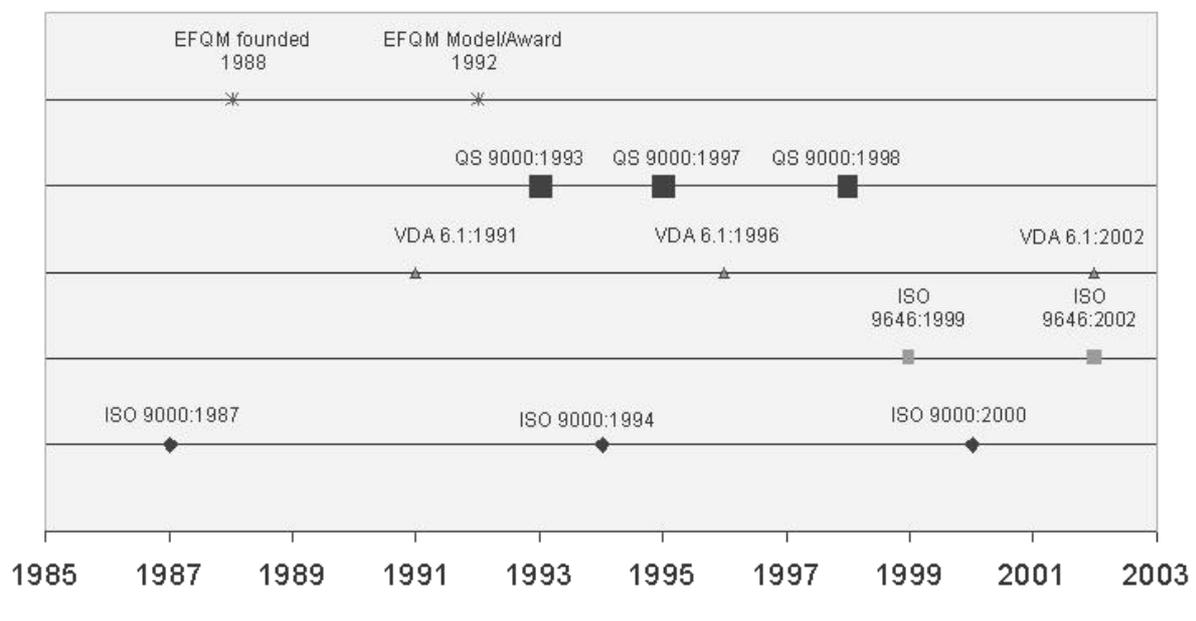


Fig. 4 - Overview of the evolution of quality standards for the automotive industry from 1987 – 2002

This overview shows the evolution of quality management standards issued since the introduction of the first set of ISO 9000 standards in 1987. It is interesting to see that upon the introduction of the ISO in 1987, other quality management systems mushroomed first at European level, then at the level of automotive associations, commencing with the VDA in Germany and followed by the QS9000 in the USA. Moreover, this overview also shows that at neither level, the standards once introduced are fixed, as all standard quality management systems are subject to regular updates. Thus, standard setters perceive that standards represent only the temporary best solution which, according to the dynamic environment they intend to regulate and have to be adapted accordingly.

To point out advantages of international standards but also their shortcomings I shall first focus on the evolution of the ISO from its origins to its current ISO 9000:2000 series. I will also examine and compare the ISO 9000 with the specific quality management systems used in the automotive industry (VDA 6.X series and the QS 9000) and to examine the implications arising from the introduction of TQM-based

holistic quality management systems such as the EFQM-model. Concluding this part, I will give critical appreciation of the quality management standards presented.

2.7.1 Historical evolution of the ISO 9000

The origins of the ISO 9000 date back to the 1950s when, based on the criterion of the Acceptable Quality Level (AQL), the US government introduced the military standards 105 (MilStandard 105) for purchases of military goods conducted during World War II (Hesser and Inklaar 1998:162). In 1963, this standard was used by the NATO and became known as the US MIL-Q 9858. Based on the US MIL-Q 9858, during the early Thatcher years, the British arms industry adopted this NATO standard. As British National Standard 5750 (BNS 5750) it was adapted for a non-military context. Walgenbach concludes that "die positiven Erfahrungen, die im militärischen Bereich der NATO-Mitgliedsländer mit genau festgelegten und überwachten Elementen von Qualitätsmanagementsystemen gemacht wurden, führte dazu, dass dieses Systeme auch im zivilen Bereich der betreffenden Industrieunternehmen genutzt wurden" (Walgenbach 2000:122). At the same time though, since the 1970s other national bodies had also started to introduce quality standards. This led to a "fragmentation of rules for quality systems" of business players (Hesser and Inklaar 1998:162). The difficulties of companies to reconcile these, different, often contradictory standards, raised the necessity to "standardise uniform models for the elements of quality systems" (ibid.) and both customers and governments demanded the "Transparenz und Dokumentation von Qualitätssystemen." (Seghezzi 1999:103). Encouraged by the British, in 1987, the ISO used the BNS 5750 as a "prototype" for the ISO 9000 series (Hancké and Casper 2000:175). Particularly the British urged for the creation of an international standard to counterbalance the dominance of the label "Made in Germany", according to Klotz, "die internationalen Normenreihe ISO 9000 wurde in der Thatcher-Ära vor allem auf Drängen Grossbritanniens entwickelt, einen Gegenpol zum (damaligen) Qualitätsbegriff "Made in Germany" " (Klotz 1996:48). Published by the DIN-Mitteilungen in 1985, Premier Minister Margaret Thatcher, on the occasion of the inauguration of the new building for the British Standards Institute, noted:

"Das Ministerium für Handel und Industrie fördert mit tatkräftiger Unterstützung von BSI einen nationalen Werbefeldzug für Qualität (...).Das Ziel dieses

Werbefeldzuges ist es, die Topmanager in diesem Land von den Wettbewerbsvorteilen zu überzeugen, die für Unternehmen durch effektive Qualitätssicherungssysteme zu erreichen sind.” (Thatcher 1985:232)

The purpose of the ISO was neither to create, nor to acknowledge the existence of a “one-best” quality management system: “ein universell geeignetes Qualitätsmanagementsystem kann es (...) nicht geben; folglich kann man ein solches System auch nicht normen” (DIN 1994:5). Instead the ISO attempted to harmonise the elements which constitute a quality management. According to Walgenbach then, “nicht das Qualitätsmanagementsystem selbst soll durch die DIN EN ISO 9000er Normenreihe genormt werden... sondern die Normen beinhalten Darlegungsforderungen an das Qualitätsmanagementsystem” (Walgenbach 2000:2). Seghezzi goes as far as suggesting that the ISO 9000 is a standard model which “legt fest, was im Rahmen eines Führungssystems getan werden soll, sagt jedoch nicht, wie dies zu geschehen hat” (Seghezzi 1999:104).

The perception of the German industry towards the creation of a standardised quality management system was reluctant. During the mid-70s, in the wake of extending the tasks of quality assurance beyond its initial focus on production, German quality engineers had attempted to introduce “Normen zur Dokumentation von Qualitätssicherungssystemen” (Walgenbach 2001:7). These aimed at institutionalising the label and image of “Made in Germany” into a formalised set of standards (Hesser and Inklaar 1998:162). However, these early attempts were met with scepticism, as the quality behind the label “Made in Germany” was seen to originate from a degree of organisational freedom and the proposed standards were feared to present an “Eingriff in die Organisationsfreiheit und eine Standardisierung des Management” (Walgenbach 2001:7).

This attitude prevailed, as the first drafts of the ISO 9000 were discussed. Particularly the following paragraph of the DIN ISO draft was criticised as it was considered to point towards an increased regulation of work:¹¹

“Tätigkeiten der Nachweisführung müssen von Personal ausgeführt werden, das unabhängig von dem ist, welches unmittelbar für die Ausführung der Arbeit zuständig ist. Die Nachweisführung muss Entwurfsprüfung,

¹¹ This statement is also reminiscent of the Taylorist division between mental and physical work.

Fertigungsprüfung, Überwachung und interne Qualitätsaudits bezüglich des Qualitätssicherungssystems oder Produkts einschliessen." (DIN 1985: Gliederungspunkt 4.1.2.2, Anmerkung 2)

Walgenbach summarises this criticism insofar "dass Herstellern ein stark formalisiertes Sicherungssystem ohne Rücksicht auf Produkt- und Firmenstruktur aufgezwungen werden würde, mit der Folge, dass die Abläufe im Unternehmen erstarrten, die Flexibilität verlorengehe und der Sachverstand qualifizierten Personals auf das Abhaken von Checklisten degradiert würde" (Walgenbach 2000:164). In short, "Qualität würde eher auf dem Papier verwaltet, als vor Ort an den Komponenten produziert" (ibid.).

Furthermore, regarding the particular structure of the Germany workforce primarily consisting of highly skilled Facharbeiter, "monitoring the product quality was an integral part of the workers' tasks" (Hancké and Casper 2000:181). An inherent job responsibility which the German industry thought, could not be regulated by national standards (Seghezzi 1999:106ff.). Needless to state that the German stand was challenged as the ISO 9000 was officially ratified in 1987. According to Walgenbach and also Boehling (1991), Germany, as active member of the ISO and the EU commission, yielded to its implementation with a degree of "erzwungene Akzeptanz" (Walgenbach 2000:211). But how was the final submission to ISO 9000 quality standards perceived from the perspective of the automotive industry ?

To appreciate the role of the automotive industry in this context, it is first of all important to understand what the ISO 9000 actually intends to regulate. For this purpose, I shall give a systems overview.

2.7.2 ISO 9000 – a standardised quality management system

The ISO 9000 standards were drafted independently from particular national practices but instead focused on providing standards for "a variety of commercial settings"(Hancké and Casper 2000:176). Thus, "requirements for quality management systems are generic and applicable to organisations in any industry or economic sector regardless of the offered product category" (DIN 2000a:9). It is noteworthy to point out that the suppliers were the first to implement the ISO 9000 series followed by final assemblers (Hancké and Casper 2000:182).

ISO 9000 standards are based on the assumption that successful companies need to be directed and controlled “in a systematic and transparent manner” (DIN ISO 2000a:6). Success is seen in terms of customer satisfaction. The implementation and maintenance of a quality management system which strives for “continually improving performance while addressing the needs of all interested parties” (ibid.) is therefore considered one success factor. In other words, the ISO 9000 series “provides rules for a management system that *produces* quality”(Hancké and Casper 2000:178) and “contains the principles for the definition and introduction of quality systems as well as for their demonstration to third parties” (Hesser and Inklaar 1998:171).

Looking at its structure, the term ISO 9000 is a heading for a “coherent set of quality management standards” (DIN 2000a:6) and consists of a family of three series of “prescriptive technical norms” (Hancké and Casper 2000:176). According to Seghezzi, the ISO 9001 focuses on providing standards for quality assurance (Seghezzi 1999:105). In other words, it “specifies requirements for a quality management system” (DIN 2000a:6). It contains 20 quality assurance methods, related to the production, installation, servicing and design activities of a company.¹² The ISO 9002 contains 18 methods. It focuses on providing standards for the “Qualitätslenkung”, aiming to regulate processes and to prevent the production of faulty parts (Seghezzi 1999:105). The ISO 9003 with 12 quality elements is the least comprehensive and primarily offers standards for the packaging and distribution industries, mainly providing standards for quality inspection and tests (ibid.). The ISO 9004 “provides guidelines that consider both the effectiveness and efficiency of the quality management system” (DIN 2000a:6).

I shall now take a closer look at the ISO 9000 and ISO 9001.¹³ The first part of the ISO 9000 headed “Fundamentals of quality management”, sets the parameters for quality management standards in three sections: an introduction including general systems overview and eight quality management principles; scope or applicability of the ISO 9000 series and finally, the fundamentals of quality management systems (ibid.:8).

¹² For a detailed comparison between the ISO 9000 series, refer to the comparative matrix of Seghezzi 1999:110

¹³ The choice of these two parts of the ISO was made as are also the most common basis of certification in the automotive industry (Paradis and Small 1996)

In the general introduction the purpose of the ISO 9000 standards is defined "to assist organisations, of all types and sizes, to implement and operate effective quality management systems" (ibid.:6). In addition it contains eight quality management principles. These give an account of the necessary aspects involved in quality management: "customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making and mutual beneficial supplier relationship" (ibid.:7). For example, the involvement of people is defined as "people at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit" (ibid.). The process approach is defined as "the systematic identification and management of processes employed within the organisation and particularly the interactions between such processes is referred to as the process approach" (ibid.:10). The crucial question is though, how can the ISO 9000 ensure that this process approach is adhered to and the people implement and apply the ISO standards correctly ?

The answer is provided in section 2.8 which sets out that the adherence of ISO 9000 standards is to be checked by audits whereby a comprehensive audit is made every three years and interim audits are conducted every six months. The audit itself is regulated by standards set out under the ISO 9000 and its goal is to check on the effectiveness, adherence or deviation of ISO 9000 standards (Antoni 2001:142). According to the ISO 9000 each company filing for certification has to provide documentary evidence of the adherence of ISO 9000 standards. This evidence is presented in the so-called ISO 9000 Handbook. The main focus of the ISO 9000 audit is to check if this document contains the written evidence confirming the application of quality standards. Details about the ISO 9000 audit are provided by the ISO 19011. With regard to the audit administration, the ISO itself does not assess or audit quality systems these tasks are delegated to accredited audit organisations, in the case of Germany, to the quality inspection section of the Technischer Verwachungs Verein (TÜV). According to Walgenbach, independent certification companies conduct the ISO audit, "weil durch diese die Übereinstimmung der Dokumentation mit den Forderungen der Normen sowie die Übereinstimmung der Dokumentation mit den tatsächlichen Arbeitsprozessen durch einen unabhängigen Dritten überprüft werden soll" (Walgenbach 2000:378).

To resume so far, the ISO 9000 provides a document intended to be used by companies across industrial sectors. Its core intention is to provide a set of guidelines on how to manage quality. The ISO 9000 identifies eight core areas which quality management has to focus on: customer, leadership, people, processes, continual decision making and suppliers. However, instead of providing a stringently formulated set of standards, the ISO 9000 is rather vague, a point I will come back to. To ensure that these standards do nevertheless reflect the best possible recommendations, the ISO 9000 is regularly updated.

Despite its 1994 update, the ISO 9000 continued to be based on a “proliferation of standards” (ISO 2000b:2), and therefore a leaner system of standards was called for. Reacting to this concern, the ISO thus revised the ISO 9000 series and issued the revised ISO 9000:2000 version. The diagram below shows the transition of the ISO 9000:1994 series into the latest 2000 edition:

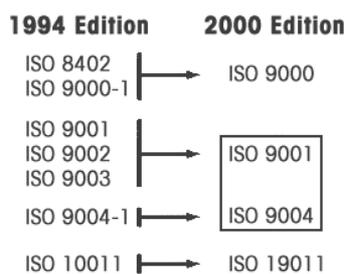


Figure 1
Correspondence Between the 1994 and 2000
Editions of the ISO 9000 Family

Fig. 5 - The integration of the 1994 edition of the ISO 9000 series into the latest ISO 9000:2000 edition.

Commencing with the structural changes, the updated version now consists of “four primary standards supported by a considerably reduced number of supporting documents” (ibid.). The fundamentals, definitions and quality vocabulary was continued as ISO 9000:2000, the three ISO series 9001, 9002 and 9003 were consolidated into one standard. The updated versions of ISO 9001 and ISO 9004 standards were developed as a “consistent pair” whereby the former provides the necessary requirements, and the latter “is intended to lead beyond the ISO 9001 to enhance satisfaction for interested parties” (ibid.). In other words, quality has been extended from the focus within organisations to providing quality standards to enhance customer satisfaction. Regarding the changes in content, according to Hesser and Inklaar, “the new ISO 9001 is intended to support process-oriented QM

systems and incorporate continuous improvement of the QM system as an additional demand”(Hesser and Inklaar 1998:193).

2.7.3 The evolution of the ISO technical standard (TS) 16949

In order to provide specific guidance of the application of ISO 9000 standards for the automotive industry, the ISO/TS 16949:1999 (ISO/TS 16949 thereafter) was introduced in 1999. This set of standards was proposed by the International Automotive Task Force (IATF), a working team consisting of representatives of both the automotive industry including the consolidated former Big Three, Ford, GM and DaimlerChrysler, PSA, Renault SA and Volkswagen, and professional associations notably amongst others the Automotive Industry Action Group (AIAG) for the USA and the VDA – Quality Management Centre (VDA-QMC) for Germany. The purpose of founding the IATF was to develop an international consensus regarding the provision of standards for quality management systems initially for its actual members but also open for any business active in the automotive sector. The IATF is also responsible for developing audit guidelines and training programmes for the ISO/TS 16949.

Regarding the development of the actual standards, the ISO/TS 16949 consists of a “Forderungskatalog”(VDA-QMC 2002:2) harmonising the quality management standards issued by its constituent member nations, such as the QS 9000 for the USA and the VDA 6.X series for Germany with the ISO 9000. This catalogue represents the “QM-Systemanforderungen für Zulieferanten in der Automobil-industrie” (ibid.). Albeit the ISO/TS 16949 provides an international set of standards, it does not replace individual national standards such as the VDA 6.X series or the QS 9000. Instead, it offers an additional option for suppliers to be certified according to internationally acknowledged quality systems standards (ibid.). So how do the VDA and the QS 9000 differ compared to the ISO ? Moreover, do they provide a more suitable set of quality standards for the automotive industry ?

2.7.4 VDA 6.X series

Upon introduction of the ISO 9000 in 1987, the DIN adapted these international standards in their official catalogue of norms. However, recognising the necessity to integrate and adapt the general ISO 9000 standards to the particular context and environment of the automotive industry, a VDA working group, responsible for the

standardization of technical norms, set forth to “consolidate the most useful standards from each of these series into a common quality management system package” (Hancké and Casper 1996:16) which could be used throughout the German automotive industry. Keeping in mind the particular needs of the industry, the committee adapted the ISO standards adding necessary standards such as, for example, the use of statistical process controls for mass producers delivering on a JIT basis. This effort by the VDA helped manufacturers and suppliers to save time, money and effort and contributed to a harmonisation of standards within the automotive industry. The VDA quality management series VDA 6.X series was introduced in 1991.

Since August 1, 1997, these VDA quality standards are administered by the VDA Quality Management Centre (herein referred to as QMC). Being able to draw from 400 freelance staff from the automotive industry organised in 21 committees, the QMC is responsible for the continuous update and translation of standards set by the ISO to the specific context of the German automotive industry. Since September 1997, BMW, DaimlerChrysler and Volkswagen demand their European Original Equipment Manufacturers (OEMs) to be certified according to VDA 6.1 (VDA 2002). Looking at the structure, the VDA 6.X standards series is divided into the following six parts:

Qualitätsstandard der deutschen Automobilindustrie

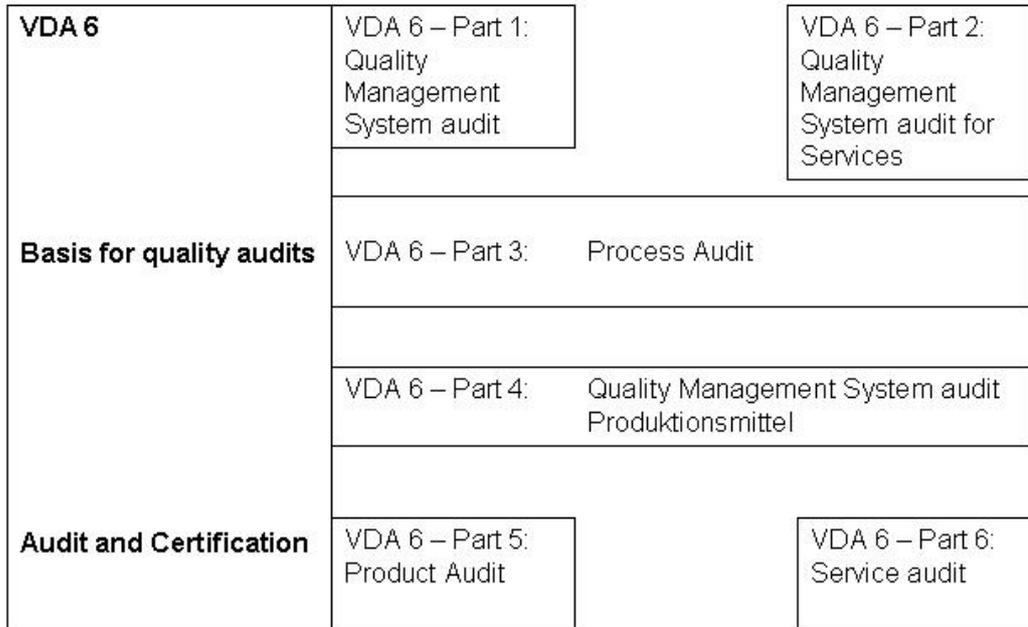


Fig. 6 - Overview VDA 6.X audit series. Source: VDA 6.1, 1998:7

Concerning the automotive industry, manufacturers primarily file for certification according to the VDA 6.1 systems audit and I shall therefore specifically focus on this part of the VDA series (towards the end of the chapter, I will examine the implications that arise from using audits generally as control and verification tools).

The fulfilment of the VDA criteria is checked by means of an audit. According to the VDA, "der Auditor beurteilt Festlegung und Wirksamkeit der QM-Massnahmen entsprechend der Erfüllung der jeweiligen Anforderungen, indem er zunächst feststellt:

Ist der Fragengegenstand im QM-System, in Abläufen, Zusammenhängen und Zuständigkeiten schriftlich (z.B. im QM-Handbuch, in einer Verfahrens- bzw. in einer Arbeitsanweisung) festgelegt ?

Dann hat er weiter zu bewerten:

Ist der Fragengegenstand in der Praxis wirksam nachgewiesen ?" (VDA 2000:20)

To evaluate the fulfilment of standards, the auditors use a rating scale ranging from 0 to 10 points with levels at 0, 4, 6, 8 and 10 points. Each score is verbally differentiated between zero points ("Nicht wirksam nachgewiesen") to 10 points ("QM System vollständig festgelegt und auch wirksam nachgewiesen"). (VDA 6.1 2000:21) . The "Erfüllungsgrad eines QM-Elements" is thus calculated and the result ranked according to following table.

Gesamterfüllungsgrad in %	Beurteilung des QM-Systems	Bezeichnung der Einstufung
90 – 100	Erfüllt	A
80 – 90	Überwiegend erfüllt	AB
60 – 80	Bedingt erfüllt	B
Unter 60	Nicht erfüllt	C

Fig. 7 - Einstufung bei Kunden-/Lieferanten (Second party audit). Source: VDA 6.1 2000:23

Certification for three years is only issued for companies reaching a level of 90% and above (ibid.:25). In interviews I conducted, quality managers at the Mercedes-Benz plant Untertürkheim at centre Z stated that in their quality management department, the VDA 6.1 series represents by far the most important audit. The key role of the audit is underscored as it was developed by 27 companies from the German automotive industry.

The VDA 6.1 is divided into two parts. Each part is in turn split into standards defining a) management responsibilities, and b) standards defining product and processes. In an introduction, each QM-element is briefly introduced and visual references to particularly significant influences on the stability of processes and product are made. Each question consists of the "Fragestellung" and a "Definition" (ibid.:38). Taking the example of the first section of the VDA 6.1, covering the management of the company, paragraph 01 "Verantwortung der Leitung" first relates the paragraph to its equivalent section in the ISO 9000 series and continues to define the general parameters of the audit questions:

"Die Leitung (z.B. Geschäftsleitung, Werkleitung, Spartenleitung) entwickelt die Qualitätspolitik für ihr Unternehmen, legt diese fest und verpflichtet sich alle Bereiche und Ebenen darauf. Hierbei sind konkrete Qualitätsziele sowie

ein Qualitätsmanagementsystem (QM-System) zu vereinbaren. Qualität ist als Gesamtführungsaufgabe zu verstehen. Mit Leitung ist diejenige Organisationseinheit im Unternehmen bezeichnet, die für Gewinn und Verlust verantwortlich ist.”(VDA 6.1 2000:39)

After this general introduction specific questions regarding the management of quality in the company are posed, as above they are also referenced with the respective or equivalent sections in the ISO 9000. For example, “01.1 Ist die Qualitätspolitik von der Leitung des Unternehmens festgelegt und auf allen Ebenen bekannt gemacht worden ? 01.2 Sind im Rahmen der Unternehmensplanung bzw. der Qualitätspolitik Qualitätsziele festgelegt, werden die Ergebnisse überwacht ?

01.3 Ist ein kontinuierlicher Verbesserungsprozess Bestandteil der Qualitätspolitik ?” (ibid.)

In this particular example, the first two questions can be traced back to the ISO 9000 series, whereas the last one has no equivalent and reflects the specific quality criteria developed for the automotive industry and in detail audits specifically the “Verringerung der nicht-wertschöpfenden Tätigkeit (z.B. Nacharbeit, Reparaturen), Vereinfachung der Abläufe/Optimieren der Fertigungsmethoden, Minimieren der Verluste.”(ibid.:43). Insofar then the VDA 6.X series provides a much more industry specific tool for quality management.

2.7.5 QS 9000

Issued by the Automotive Industry Action Group (AIAG), the American counterpart of the VDA, the equivalent of the German VDA 6.X series is the American QS 9000. Whereas the VDA represents the entire German automotive sector, the AIAG is dominated by its founding members, the Big Three US automakers, Ford, GM and Chrysler and thus reflects their particular quality management needs. The QS 9000 is an example of how company internal quality management standards found their way into national standards for quality management. The origins of the QS 9000 date back to a report about the Japanese competitiveness issued by Arthur Andersen in 1980 whereupon the AIAG was founded in 1982 to provide an “open forum where members co-operate in developing and promoting solutions that enhance the prosperity of the American automotive industry” (AIAG 2002:purpose statement). Even before the issuance of the ISO 9000 standards, the AIAG issued its first

industry standards for quality certification in 1986. In 1993, the Supplier Quality Requirement Task Force distributed the first set of quality requirements termed QS 9000, aiming to “harmonize the fundamental supplier quality manuals and assessment tools” (AIAG 1998:1). Both the VDA 6.X series and the QS 9000 were developed from the ISO 9000 series and offer thus a comparable system of quality management standards.

The QS 9000 is divided into three sections. The first section reiterates the standards of the ISO 9000 series plus specific quality demands. Focusing on the specific needs of the automotive producers, the second part consisting of the 20 ISO 9001:1994 methods in addition to 3 sections describing quality standards which regulate “Produktionsteil-Freigabeverfahren”, continuous improvement processes and manufacturing capabilities. Part three contains special cases of client specific quality demands of the Big Three (Loos 1998:19).

Since 1997 the Big Three demand the certification of their suppliers according to QS 9000. This prerequisite was extended to the entire DaimlerChrysler Corporation after the official merger and the company now conducts all three major quality system audits: VDA 6.1, QS 9000 and ISO/TS19646 (Valade 1999:1).

2.7.6 The key differences between the ISO 9000, VDA 6.1 and QS 9000

Both the QS 9000 and the VDA 6.1. go beyond the standards set by the ISO 9000 series. A detailed analysis of the differences of each set of standards is beyond the scope of this present study. Suffice to examine three particular examples reflecting on the divergent perspectives of the three systems.

Regarding the management’s responsibility for the quality system, the QS 9000 requests additional documentation of organisational interfaces. Both the VDA 6.1. and the QS 9000 stress the need for continuous improvements regarding the management of the quality system, particularly concerning the control function of management.

It is furthermore interesting to see that both the QS 9000 and the VDA 6.1 stress the importance of customer orientation as part of the management’s responsibility for quality management. The focus on the customer within the quality management systems is also evident in standards regulating the dissemination and collection of data which according to QS 9000 and VDA 6.1 should include information about customers. Additionally, standards regulating quality management training,

particularly in the QS 9000 demand that training provides insight into customer specific needs. Thus, QS 9000 and VDA 6.1 additionally focus on providing standards which link quality with customer satisfaction.

Moreover, there are differences regarding the regulation and the labelling and tracing of products. Particularly the VDA 6.1 demands are more detailed and more stringent than the QS 9000 and the ISO 9000.

For standards regulating the treatment of faulty parts, the QS 9000 adds standards for labelling defective parts, whereas the VDA 6.1 proposes additional standards regulating re-work and a system for recognising recurring errors. In other words, the VDA 6.1 is more concerned with the treatment and prevention of errors whereas the QS 9000 focuses on the visualisation of errors. The QS 9000 goes beyond standards of the ISO 9000, by including standards for problem solving techniques and the examination of returned parts. In contrast, the VDA 6.1 sets out far more stringent measures for analysing the actual root causes of errors, error risks and repetitive errors. In other words, whereas QS 9000 sets out standards for a problem solving techniques (error detection), the VDA 6.1 focuses on setting standards which aim at eliminating the root cause of the errors (error prevention).

Despite refining the ISO 9000 standards, the QS 9000 and the VDA 6.1, in my opinion, all three quality management systems lack the holistic view of quality encompassing the entire organisation. Recognising this, in addition to ISO 9000 based standard quality management systems, the total quality management perspective was institutionalised through the in the European Foundation of Quality Management (EFQM) model. In the following part I shall analyse the function of this model, particularly the degree to which it institutionalised the Japanese quality management principles discussed above.

2.7.7 Towards a holistic view of quality – from ISO 9000 to the Total Quality Management System (TQM) of the European Foundation of Quality Management (EFQM).

As seen above, the ISO 9000 provided a first attempt to set standards for controlling the entire process chains, however, at the same time, spreading from Japan and publicised by the MIT study, a holistic quality perspective, the Total Quality Management (TQM) approach (also known through Peters and Waterman (1984) as Excellence Model) - in Japan known as company-wide quality control - challenged

the prevailing view of quality management. A change in understanding led to the perception that quality is a responsibility and "Aufgabe aller Mitarbeiter" (Ketting 1999:29). The sustained quality satisfaction of the customer is a company-wide task of all members of staff. Moreover, customer satisfaction and the integration of the tacit knowledge of staff into a continuous system of improving quality and performance standards are key aspects characterising TQM (Seghezzi 1999:112). In order to achieve these goals, TQM draws on four aspects. First, management responsibilities and role model function (Juran 1995:650) stressing the double meaning of Borgward's statement that "Qualität beginnt im Kopf" (Borgwards 1987:577). Second, the quality management system is enshrined in the official quality policy of the company. Third, quality tools such as FMEA analysis are deployed. Fourth, quality standards are subject to a continuous improvement process (Frehr 1999:35).

These four aspects of TQM aim to help companies achieving quality of products, a company-wide quality awareness and quality of skills performed. In other words the four pillars of TQM support a holistic view of quality within the company (ibid.). The function of management, for example is the "ständige, fördernde Begleitung" of the TQM process and managements' attitude and behaviour is oriented on a "Vorleben der kontinuierlichen Qualitätsverbesserung im täglichen, persönlichen Auftreten und Handeln" (ibid.:38). Moreover, amongst others, management is responsible for allocating appropriate funds to support the continuous TQM process, to offer training opportunities, to incorporate necessary TQM measures in budgets and to control the TQM process by instigating regular TQM audits.

In order to institutionalise quality management as a "habit of improvement" (Juran 1995:650), aiming to improve the competitive position of the European industry, major European managers founded the European Foundation for Quality Management (EFQM). This foundation aims at providing companies with additional quality standards, based on the TQM model which go beyond the ISO 9000 demands.

Recognising that "the battle for quality is one of the prerequisites for the success of your company and for our competitive success" (Delors 1998) presidents of 14 major European companies, including Volkswagen and Fiat, founded the EFQM in 1988 to provide a "European framework for quality improvements" (EFQM 2000:1 and Malorny 1999:203). Based on a standardised framework for self-assessment, the

EFQM Excellence Model was developed by 1991. It serves as a judgement tool for companies entering the European Quality Award and thereupon has been introduced as an organisational self-assessment tool throughout European businesses. As a non-prescriptive framework, the EFQM Model is divided into nine categories, five of which relate to what the company does ("Enablers") and four focus on the achievements of the company ("Results") (Seghezzi 1999:113). The implementation of each category is evaluated according to a scoring system. The five categories of enablers are:

- leadership (representing 10% of the total score, i.e. 100 points)
- staff orientation (representing 9% of the total score, i.e 90 points)
- policy and strategy (representing 8% of the total score, i.e 80 points)
- resources (representing 9% of the total score, i.e 90 points)
- processes (representing 14% of the total score, i.e 140 points).

The four categories of results are:

- staff satisfaction (representing 9% of the total score, i.e 90 points)
- customer satisfaction (representing 20% of the total score, i.e 200 points)
- social responsibility (representing 6% of the total score, i.e 60 points)
- business result (representing 15% of the total score, i.e 150 points).

The differences in the weight attached to each category shows that the evaluation according to the EFQM model primarily focuses on assessing the total quality of a company in terms of the quality of processes and customer satisfaction. The key premise is that:

"Excellent results with respect to Performance, Customers, People and Society are achieved through Partnership and Resources, and Processes" (EFQM 2000:4).

It is interesting to see that similar to the ISO 9000 standards, the universal applicability of the EFQM model is due to both the vagueness of this premise and the categories. For example, instead of providing a quantitative measure of the term

“performance”, according to the EFQM, performance is “a measure of attainment achieved by an actor, team, organisation or process” (EFQM 2000:7) Thus the model falls short in supplying concrete variables for evaluating and measuring quality results. Nevertheless, the empirical studies of 140 TQM award winning companies over two five year periods by Singhal and Hendricks (2000) suggest that in the long haul, there is a positive correlation between the implementation of the TQM models such as the EFQM and the financial performance of companies (stock price, operating income and net cash flow) (Hendricks and Singhal 2000).

To some extent, the ISO 9000 is similar to excellence models such as the EFQM, because "both approaches enable an organization to identify its strengths and weaknesses, contain provisions for evaluation against generic models, provide a basis for continual improvement and contain provisions for external recognition" (ISO 9000:2000:17).

However, the key difference between these two approaches "lies in their scope of application" (ibid:18). The ISO 9000 standards contain "requirements for quality management systems and guidance for performance improvement" (ibid.) whereas excellence-based models "contain criteria that enable comparative evaluation of organizational performance and this is applicable to all activities and all interested parties of an organisation" (ibid.). In other words, the ISO 9000 focuses primarily on quality standards, excellence models like the TQM represent a holistic approach towards quality management which encompasses all processes and the entire staff throughout the whole organisation.

In addition to this differentiation by the ISO, Seghezzi points out that a second short coming of the ISO is that the ISO 9000 audits are limited to checking documentary evidence instead of providing input for planning and strategic management, thus, “für die Evaluation benötigt man ein neues Instrument, das sogenannte Assessment, das wichtigen Input für die Planung und die Verbesserung liefert sowie gleichzeitig den Wandel des Unternehmens stützt” (ibid.). According to the EFQM, this “self-assessment is a comprehensive, systematic and regular review of an organisation's activities and results referenced against the EFQM Excellence Model. The Self-Assessment process allows the organisation to discern clearly its strengths and areas in which improvements can be made and culminates in planned improvement actions which are then monitored for progress” (EFQM 2000:1).

Third, the ISO 9000 does not promote the competition for quality between companies. Malorny argues that the aspect of quality as a competitive advantage, or business excellence, has to be exploited and therefore a European equivalent of the American Malcom Baldrige National Quality Award (since 1988) or the Japanese Deming Prize (since 1951) was to be introduced (Malorny 1999:203ff.). This measure would allow increased competition for quality among European companies and would also establish a benchmark for European and international comparison of quality levels and achievements.

In my opinion, the key advantage of the EFQM-model lies in the fact that it encourages the self-evaluation of quality standards within companies. Whereas the ISO 9000 audits provide a third party analysis by auditors, often not familiar with the particularities of the assessed industrial and technical environment, the EFQM places the responsibility for assessment into the hands of those actually working within this environment. As tools for self-evaluation, the EFQM has introduced the RADAR logic and the RADAR Scoring Matrix. The former supplies a standardised logical sequence for self-analysis, covering the acronyms: “determination of **R**esult, planning and developing of **a**pproaches, **d**eveloping approaches, **a**ssessment and **r**eview of approaches” (EFQM 2000:5).

The latter, provides a series of questions aiding the self-assessment check, thus allowing companies to determine areas of improvements. To sum up, the work of the EFQM and its proposed model supplement the ISO 9000 standards insofar as they aim to institutionalise the TQM model which treats quality as a holistic system which incorporates the concerns of suppliers, customers, staff, shareholders and management alike. The number of businesses applying the EFQM model has been growing rapidly, and according to the EFQM in 2000 exceeded 20.000 businesses in Europe (EFQM 2000). In terms of differences, the ISO 9000 series “provides requirements for quality management systems and guidance for performance improvement”, whereas the excellence models “contain criteria that enable comparative evaluation of organisational performance” (EN ISO 9000:2000:18).

2.7.8 Audits

Be it through the self-inspection performed by craftsmen or through the "Tuchschau" performed by guilds and external inspectors, the historical account above has shown that the control of quality in form of audits has played a key role in the evolution of standards. This importance continues today as the audit has a key function for quality management systems. Its purpose is to check the effectiveness and efficiency of the quality management system. Thus the audit evaluates to what extent quality standards have been implemented, are applied and adhered to. According to Antoni, the audit thus "hat eine wesentliche Steuerungsfunktion und kann gravierende Konsequenzen nach sich ziehen" (Antoni 2001:139).

The DIN ISO 10 011, part 1, defines a quality audit as "a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives" (DIN ISO 10 011, part 1:5).

Gaster (1984) and Wilhelm (1993) differentiate between three types of quality audits: product audit, process audit and system audit. These audits can be conducted either by internal or external auditors.

Internal audits or self-evaluations, as I shall discuss in detail in the case study about the introduction of the Mercedes-Benz Production system are conducted either by actors on the shop floor or by auditors of the quality management department.

This raises the problem as to the role and influence of the auditors on the audit result. To increase the degree of objectivity, Antoni points out that "sich ein Bereich nicht selbst beurteilt, sondern beispielsweise von seinem internen Kunden oder einer Stabsstelle beurteilt wird" (Antoni 2001:141). According to Zink, internal audits primarily serve to give internal impulses and feedback to encourage the continuous improvement of processes (Zink 1999). By providing a feedback loop and results of the internal audits are fed back into the system, Power points out that internal audits have a "certain learning potential" (Power 1997:83). Moreover, as a "form of structured self-observation" the internal audit represents a "form of second order control" in addition to the external first order control (ibid.).

External audits serve one key purpose: to issue an audit certificate. Like the MOT (Motor Operating Test, the equivalent of the TÜV in Germany), a car has to pass, companies have to pass the audit to get, for example the ISO 9000 certification. Interestingly as insofar, both car and company are "audited" by the same external

institution, the "technical inspectorate", in German the Technischer Überwachungsverein (TÜV).

Moreover, this shows that the standard setting function and the standard auditing function are treated as separate activities, performed by two external organisations: the ISO, and in case of Germany the DIN are responsible only for setting standards and accredit independent certification institutions to perform the audits of their standards. In Germany, the auditing role is predominantly performed by the TÜV as a "private-sector regulatory body" (TÜV 2002:1). For this purpose, the TÜV set up a department the TÜV Management Service Division which is "accredited to conduct registration/certification auditing to the automotive and other industries by the German Accreditation Council (DAR) and the US Registrar Accreditation Board (ANSI-RAB) for ISO 9000, QS-9000, TE Supplement and ISO 14001 certification, as well as the German Department of Transportation (KBA) for VDA 6.1 and the German member of the International Automotive Task Force (VDA-QMC) for ISO/TS 16949 automotive quality systems certification" (TÜV Management Service 2002:1).

This division has several implications. First, the main purpose of using external auditors and audit companies is to provide a more objective view and evaluation of companies. On the other hand though, external auditors are not acquainted with the particular products, market or production environment of the company performs the audit. The accusation of companies that auditors are thus too far removed from the actual internal company practices is justified in my view, as I shall discuss in detail in connection with the role auditors in the audit of the Mercedes-Benz Production System (MPS) below.

Second, the shift towards using external standard setting and standard controlling institutions, weakens the role of planning departments, especially Industrial Engineering departments, within companies. Traditionally, their role was to plan, set and to control standards within companies. This influence is being eroded and weakened particularly as the function to control standards is now being performed by either internal or external audit departments and institutions: the role of the Industrial Engineering profession is now being taken over by the auditing professions. This marks the rise of a new elite of specialists. Moreover, the decline in the Industrial Engineering as a profession is also reflected in the decline of the influence and power Industrial Engineering associations, such as the REFA exert in German companies. The function of the REFA in the past has been to issue industry wide

REFA-methods and the so-called "REFA-Schein" (REFA-certificate) was a "standard" qualification accepted across industries and a "standard" qualification that skilled workers and Industrial Engineers alike, could take. However, in interviews I conducted with REFA-members, it was stated that the number of REFA-certificates issues has decreased drastically. The reduction in the number of staff in Industrial Engineering departments and the integration of these departments, for example into central planning departments, reflect the decline in the importance of the Industrial Engineering profession. At the same time, quality management departments and particularly audit departments have mushroomed. According to Power (1999), this shift signals "an 'audit implosion' whereby organizations have become more 'reflexive' and where company directors have been forced to acquire responsibility for internal control systems and risk management" (Power 1997:xvii). As a result an "internalisation of regulation" (ibid.) has occurred with the consequence that particularly internal auditors "acquire more of the substance of the external financial auditor's role" (ibid.).

Third, the independent validation by external auditors and audit institutions "connects the organization to other regulatory layers" (Power 1997:85). According to Power, in theory "regulatory and corporate programmes coincide in the structure of a system which serves internal economic and external regulatory goals simultaneously" (ibid.). As a result, audit system introduce a high degree of bureaucracy into organisations. Audits are conducted at regular intervals and in preparation staff have to update audit handbooks and prepare the relevant documents the auditor will look at. This preparation takes time and ties up human resources in indirect bureaucratic processes which do not add direct value to goods produced or services rendered: the audit preparation is a bureaucratic exercise. Simmons and Wynne (1992) underscore this argument by suggesting that the focus of external regulatory attention is concerned with abstract, bureaucratic organisational chains. For Power, quality management systems like the ISO 9000 are "abstract from performance in a substantive sense and emphasize system values and their auditability as ends in themselves" (Power 1997:85). Unlike product audits which evaluate the quality of products, "the auditability and certifiability of the quality system is a secondary process, a means to an end" (ibid.). If audits are but ends in themselves and serve to reaffirm the regulatory role of external auditing institutions why do companies willingly submit to this process of certification ? In the following, my aim is to evaluate some of

the major costs but also benefits companies have from submitting to the process of certification.

2.7.9 The cost and benefits of certification

At the end of December 2001, at "least 510.616 ISO 9000 certificates had been awarded in 161 countries world-wide" (ISO 2002:4). By far the greatest share of ISO 9000 certificates are registered in Europe (53.9%) followed by an increasing share of Far East countries (24.8%), particularly led by 32.126 new certificates issued in China alone between December 2000 - December 2001 (ibid.:3). The share of ISO 9000 certificates issued in North America (USA, Canada, Mexico) amounts to around 10% (ibid.:6ff.).

The annual ISO certification costs (after the initial implementation) amount to around DM 25.000 (Klotz 1996:50). According to the critics then "Qualität bedeutet nur Kosten – Qualität ist teuer" (Becker 1995). But what are the benefits? Of 325 quality managers questioned in a study by Kamiske et. al (1984), around 60% stated that the introduction of the ISO 9000 series had either led to insignificant or no reduction in the number of defect parts. A second study, intended to evaluate the benefits of introducing general standards and technical rules of 4.000 companies in Germany, Austria and Switzerland, conducted for the DIN between 1997 and 2000 adds that 61% of companies affirmed that costs actually occurred through the introduction of standards (DIN 2000:12). 37% of companies linked this increase to the necessity of making additional staff available (ibid.). Regarding the benefits, 62% of companies stated a reduction in trading costs caused by the "simplification of contractual agreements" (ibid.). Only 9.3% of companies provided actual figures of monetary savings resulting from standardisation which amounted on average to DM 466.000 per annum (ibid.).

In addition to the quantitative evaluation of the costs and benefits of introducing standard, companies regard standardisation as a "time-consuming and costly" effort (ibid.10). Moreover, companies stated that internal company-wide standards "have a more positive effect on the competitive status," than industry-wide standards such as published by the DIN (ibid.:10).

These estimates have to be treated carefully insofar as participants also admitted that the "cost of developing company and industry-wide standards are not easily quantified" (ibid.:13). And although the IFAN issued the *Leitfaden 1 – Verfahren zur*

Bestimmung der Vorteile von Normungsprojekten, giving detailed instructions about the structure and methods to be used in establishing the quantitative value of standardisation, it is still difficult to precisely evaluate the benefits of standardisation and specifically the ROQ, the return on quality, in monetary terms.

Hence, if the benefits of implementing quality management systems is difficult to determine the question is, what are the reasons why companies nevertheless opt for the implementation of a standardised quality management systems ?

Conformity to standard quality management systems, particularly the ISO 9000, has been a major criteria for the selection of suppliers. According to Franke, "bei vielen Auftraggebern oder Kunden zählt nicht mehr alleine die Qualität der Produkte, sondern die Qualitätsfähigkeit ihrer Hersteller und Lieferanten. Sie wollen Vertrauen in das Qualitätsmanagement-System ihrer Zulieferer erhalten und fordern daher die Darlegung von Teilen des QM-Systems, z.B. nach der Normenreihe DIN ISO EN 9001 bis 9003"(Franke 1999:425). The ISO 9000 certificate is seen as proof (or mark !) of the existence of an efficient quality management system and "diejenigen, die sie nicht besitzen, wird unterstellt, daß sie Qualität nicht ernst nehmen" (Jackson and Ashton 1994:56). Jackson and Ashton go even as far as suggesting that ISO 9000 certification ensures the survival of companies, as it is necessary for ensuring "den Erhalt größerer Aufträge" (ibid.:55) and is thus the price companies have to pay "um einen wesentlichen Anteil der Geschäftsbeziehungen zu erhalten" (ibid.:57). In other words the ISO 9000 certificate is "eine Bedingung für das Überleben" (ibid.) and the ISO then provided a "common language"(Hancké and Casper 1996:3) of quality, harmonising the interface between automotive producers and suppliers.

Especially after 1989, as the percentage of parts manufactured in-house decreased from an average of 40-50% to 20-30% by volume (Hancké and Casper 1996:15), in order to deliver the increasingly complex parts and systems, suppliers were forced to invest in new machines. In turn, "more sophisticated production necessitated a major reorganization of the work process within most supplier firms" (ibid.). In addition to the internal reorganisation, in order to minimise buffers, manufacturers expected many suppliers to deliver their parts Just-in-time. Moreover, "final assemblers argued that they could no longer inspect all incoming parts, since the essence of Just-in-time (JIT) is delivery straight to the assembly line for immediate use" (ibid.). In the late 1980s, new contracts thus introduced went as far as asking "suppliers to perform exit inspections in place of the normal entry inspection of the final assemblers that the law

prescribed, pledged suppliers to a zero defect guarantee, and forced them to assume all liability costs should defective parts cause damage of any kind to either the final assembler or end consumer” (ibid.).

By shifting the liability risk to the supplier, “insurance companies immediately demanded higher premiums for liability insurance” (ibid.). In order to estimate the risk profile of the supplier, insurers “insisted on conducting expensive audits of every supplier’s quality control system” (ibid.). According to Hancké and Casper, “if suppliers wanted affordable liability insurance, they would have to replace the idiosyncratic routines created by workers, however robust these may be, with a quality control system that insurance auditors could understand. This was provided by the ISO 9000 norm, which became the key to both the process reengineering of German supplier firms and one of the major instruments for making new supplier relationships tolerable with the German liability law” (ibid.). The institutionalisation of the ISO 9000 series in relation with this liability issue was firmly established when in the late 1980s assemblers inserted contractual clauses “mandating that suppliers obtain ISO 9000 certification” (ibid.:16). After discussions between the VDA and the insurers, the latter accepted the VDA audits as risk-assessment tools. As an incentive, companies achieving an A or B rating are exempt from the premium surcharges caused by the new legal risks. Walgenbach thus concludes that, “die Richtlinien über die Haftung von fehlerhaften Produkten dürfte die zunehmende Verbreitung von Qualitätsmanagementsystemen (...) nochmals gefördert haben” (Walgenbach 2000:242).

2.8 Critical appreciation

Standardisation as term, is not value-free and the introduction of standardised quality management systems is surrounded by controversy. Concerning the key themes which are at the centre of this present study, it is interesting to evaluate the link between quality management systems, learning and control.

Tuckman interprets the content of the ISO on the one hand as being critical towards “rigidly defined bureaucratic roles” but at the same time is “through the establishment of procedures, centrally concerned with constructing such roles” (Tuckman 1994:732). Confirming Taylor’s role of management as a planning and controlling authority, Tuckman hence considers the ISO 9000 a “management information system hidden underneath a quality program” (see Hancké and Casper 2000:178).

Key evidence, he asserts, is that the ISO 9000 originated from economic settings, such as the UK and the USA, both firmly rooted in a Taylorist tradition (Tuckmann 1994:740). Thus, ISO 9000 was criticised for being a vehicle indirectly enforcing Taylorist organisational principles.

The issue of bureaucratic control introduced through standardisation is also pointed out by Moldaschl who warns that "im ungünstigeren Fall fördert der Normierungsaktivismus, absichtlich oder unabsichtlich, eine Formalisierung von Arbeitsabläufen. Unternehmen laufen Gefahr, mit der Festschreibung sämtlicher Vorgehensweisen, Bedingungen und Zuständigkeiten in bürokratische Gängelungspraktiken zurückzufallen (...) besonders in Unternehmen mit vielen Angestellten. Sie nähern sich dem Vorbild japanischer Unternehmen, bei denen selbst das Verfassen von Vorschriften durch Vorschriften geregelt wird" (Moldaschl 2001:120). Quality standards call for the formal documentation of processes. In turn, these processes become more transparent. As a result the control and power of actors over these processes is curbed and as one manager interviewed by Walgenbach confirmed, "das ist, wie man so schön sagt, den Mitarbeitern den Schreibtisch ausräumen. Das heisst, die müssen Informationen hergeben. Zum Teil auch das Problem, dass sie auch Macht abgeben, manche ersetzbar werden" (Walgenbach 2000:367).

However, based on interviews and observations Walgenbach conducted, a discrepancy between the intention of standards and their actual application on the shop floor exists. In his study about the practical implementation of the ISO 9000 in a number of German companies, Walgenbach points out that far from yielding to the new quality standards introduced, staff continue their work as they did before. There is thus a discretion between the formalised intention of ISO standards and their practical application (Walgenbach 2000:368). The author proposes two possible reasons for this divergence, first, staff remuneration is not linked to the "Dokumentation ihrer Tätigkeiten, sondern für ein Arbeitsergebnis aufgrund ihrer Tätigkeit" and hence "der Anreiz für den einzelnen, die Dokumentation seiner Tätigkeiten fortwährend mit dem aktuellen Arbeitsvollzug in Übereinstimmung zu bringen, ist von daher als relativ gering einzustufen" (ibid.:371). Second, Walgenbach deduces that the missing congruence between practical application ("Arbeitstätigkeit") and formalised documentation ("schriftlicher Dokumentation") is due to the "Folge der Selbstverständlichkeit, mit der Routinetätigkeiten und graduelle

Anpassung dieser Routinetätigkeit an die sich wandelnden Erfordernisse der Arbeitssituation vollzogen hat" (ibid.:373). The reason why companies decide to adopt quality management systems is then not based on a conscious awareness and need on behalf of companies to improve and control quality; instead, the competitive, social, political or industrial environment define that a quality control system is a necessary prerequisite for a company, thus "strukturelle Elemente werden adoptiert, und zwar unabhängig von ihren Auswirkungen auf das Arbeitsergebnis" (Walgenbach 2000:13). Consequently, in terms of a quality management standards, "diejenigen, die sie nicht besitzen, wird unterstellt, daß sie Qualität nicht ernst nehmen" (Jackson and Ashton 1994:56). A valid critique affirmed by the DIN survey on the benefits of standardisation in which 37% of participants felt that an "increase in pressure from their rivals because of the existence of European and International Standards" (DIN 2000:12).

This interpretation is also supported, when considering the research of Hancké and Caspar arguing that the effect of implementing ISO 9000 standards is determined by the particular national industrial preconditions, particularly firm governance, industrial relations and vocational training systems. Indeed, countries like Germany, where "highly skilled workers retained substantial autonomy" the implementation of the ISO 9000 "did not push work organisation down a neo-taylorist, hierarchical path"(Hancké and Casper 2000:183-4).

Arguing that the introduction of institutions, such as the ISO 9000, is a highly political process, the authors point out that "the struggles between large firms and their suppliers, between management and workers, and how these were mediated (or not) by institutions such as labour unions, industry associations and (quasi-) public agencies, were not just a distant background setting; they *were* the substance of the introduction of the standards" (Hancké, B., and Caspar, S., 1996:21). In view of the "politics of institutional transfer" thus raised, the authors doubt "as to whether everyone involved is actually transferring or introducing the same objectively existing institution" (ibid.). The research of Hancké and Caspar has shown that the implementation of international standard quality management systems does not reintroduce Taylorist principles of work organisation. Unlike Tuckman arguing that ISO 9000 standards reinforce and revive a Taylorist work organisation, Hancké and Casper stress that "diversity persists with just as much vigour as before" (ibid.).

One reason the authors point out why the ISO 9000 is thus able to reconcile standardisation with diversity lies in the "intrinsic flexibility of the ISO standards" (ibid.:19).

This flexibility is caused because the actual wording of the standards set out in quality management manuals is distinctly vague and formulated in an abstract manner (Klotz 1996:50). In the case of the ISO 9000, Seghezzi interprets their function in terms of thus providing a set of "Metastandards" (Seghezzi 1998:910) which merely propose the adaptation of a common "design code" (Seghezzi 1998:910). The advantage of such a degree of "Schwammigkeit" (Klotz 1996:50), is that, standards are flexible to be adapted in a variety of industrial activities and different national economic settings thus supporting the institutionalisation of standards as "a living and dynamic process which is subject to constant inspection and supplementation" (Hesser and Inklaar 1998:189). By providing this flexibility, improvements and necessary reviews are incorporated into the standards as amendments (ibid.). In other words, the vagueness of the actual wording of standards ensures some degree of formalisation of quality standards on the one hand, but also allows for a degree of flexibility in which standardisation facilitates "an optimum variety, and not by any means uniformity, rigidity and hostility to innovation" (ibid.:203). According to Seghezzi, the actual content of, for example, the ISO 9000 standards is then sufficient insofar that, "mehr darf geboten werden, weniger nicht" (Seghezzi 1999:109).

The wide spread acceptance of the ISO 9000 quality management standards is also due to the fact that they are "brought about mainly by following the consensus principle in preparing a standard, by which the largest possible agreement is secured among all interests concerned with the use of standards, such as the producer, the user, the trader and the technologist. Once all these interests have been agreed and a common ground upon which to base the standard has been found, the standard acquires an authority, possibly much more powerful than a legal instrument might which has secured only a 51 percent majority vote in its favour" (Verman 1973:12). As seen above, through their representation in professional bodies, automotive manufacturers take part in this standard setting process and thus shape the

standards for their industry, including both automotive manufacturers and their suppliers.¹⁴

Summarising, the intention of this chapter was to examine the changing forms and functions of standardisation from an historical perspective and to assess how this process is related to the rise of production systems in the automotive industry. A second strand examined was the role standard setting institutions have played in this process.

The first conclusion that can be drawn in my view from this discussion is that historically, quality represents a key function of standardisation. Over time, this function became increasingly complex and extended from providing product standards to offering process standards. Today, the holistic perspective proposed in TQM-based models envisages standards to regulate processes across organisations. These models no longer reflect an isolated view of quality management only, but are more akin to production systems in so far that they consider entire processes across the company.

This evolution has two implications. First, the TQM model has evolved as a de facto standard as a company-wide quality control model and was institutionalised as the EFQM model. Moreover, the TQM approach has to some extent been integrated in the updates of other standard quality management systems, by introducing the customer focused quality perspective in the ISO 9000:2000.

Second, the establishment of a standard model of quality management systems evened the path towards the introduction of standardised production systems. Like the TQM-based models such as the EFQM, today the TSP is considered best practice and has become a de facto standard for production systems in the automotive industry. This also marks a reversal in the driving forces of standardisation from institutionally driven standardisation to company and industry-specific driven standardisation.

Third, standards contained in quality management systems do not necessarily introduce a greater degree of control over work. Research has pointed out that there is a discrepancy between the intention of standards and the actual application of

¹⁴ For example, the involvement of actors from within the automotive industry has assured that the VDA standards reflect a high degree of consensus; consensus foremost in terms of the actual necessity to create national and international quality systems standards and second, a consensus regarding the actual content and wording of the VDA 6.X series of standards.

standards on the shop floor. Although quality standards introduced lead to a greater degree of bureaucracy, paperwork and to some extent a greater transparency of processes, in practice, actors continue performing the work as before.

Fourth, regarding the ISO 9000, initially suppliers exploited their certificate as a marketing tool (Hancké and Casper 1996:5). Particularly for companies which were the first to be certified, the ISO 9000 offered an additional marketing advantage, a new unique selling point (Hansen 1993:156). Meanwhile, it is standard practice that most companies, be it suppliers, manufacturers or services are certified according to the ISO 9000. In other words, "ein Qualitätsmanagementsystem wird zunehmend zu einer Selbstverständlichkeit" (Walgenbach 2000:9).

Finally, audits take a key role in the evolution of standardisation and raise a number of significant issues. According to Power, the rapid rise and expansion of audits are a sign of far greater social evolution, what he terms the rise of the "audit society." This rise is being witnessed as a "growing population of 'auditees' began to experience a wave of formalised and detailed checking up on what they do" (Power 1997:3). This wave of formalisation extends from financial audits, to quality audits, and, as I shall examine in detail later, also to the case of the Mercedes-Benz Production System Audit: auditing has become an unquestioned, self-evident activity which is regularly performed in companies.

With the audit wave, the audit profession and audit departments have mushroomed. This trend is significant for it signals that the traditional role of the Industrial Engineer, particularly his function to control the implementation of standards is being weakened, gradually strengthening the influence of the role of the auditor. Moreover, as Zink (1999) has suggested, particularly internal audits serve as additional feedback loops and provide internal impulses to encourage the continuous improvement of processes. Insofar audits have "certain learning potential" (Power 1997:83). At the same time though, they are also a means to an end, a self-perpetuating mechanism which exists for its own sake and for the purpose of reaffirming the institutional role and status of the auditor and external auditing institutions.

I shall now extend the focus of standardisation from quality management systems and their audits to the role of standardisation in the production systems in the automotive industry.

