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AFS Silver Anniversary Paper

Thirty Years after QS-9000: Changing Requirements and Enduring Lessons

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ABSTRACT

Ford, GM and Chrysler first published their automotive quality system standard in August of 1994. During the 1999 AFS Metalcasting Casting Congress, *AFS Transaction Paper* #99-20 was presented, titled "Keeping the QS-9000 Process Alive: Strategies After Certification." This paper provided advice regarding the proper application and implementation of a quality system that was mandated by the "Big Three" automotive original equipment manufacturers (OEMs) at the time. This *AFS Silver Anniversary Paper* reviews the history of development and change in quality management systems over the last thirty years since QS-9000 was initially published. In this review the author offers insight into the abiding themes and enduring lessons for organizations seeking to make quality system certification value added.

Keywords: quality, system, management, improvement, leadership, automotive

INTRODUCTION

Thirty years ago, the initial revision of QS-9000, titled simply, "Quality System Requirements," was published as a result of a six-year effort to harmonize the quality tools, techniques and system architecture within the automotive industry.[1] This was an historic achievement in the automotive world as it was the culmination of an unparalleled level of cooperation between three fierce competitors: Ford Motor Company, General Motors (GM) and Chrysler (The "Big Three" automakers). It also represented a substantial change in business for all automotive suppliers: now they would no longer be evaluated by their customer but by a third-party auditor that would utilize a standard set of acceptance criteria and represent the customer's interests. This evaluation process would also proceed at the supplier's cost.

The changes in the automotive industry supply base significantly impacted foundries directly or indirectly. The relationship between customers and suppliers itself was permanently altered; quality system requirements were now specified along with the usual product requirements. By 1999, much of this change had been initially met by automotive suppliers. Third-party certification was mandatory, and deadlines were established that forced compliance. The question that began to be asked at this point was "How do I maintain such a system?" or perhaps more to the point, "What do I do now?" The *AFS Transactions Paper* #99-20, "Keeping the QS-9000 Process Alive: Strategies After Certification," was written to respond to that need 25 years ago.[2]

Today quality systems have, if anything, become a more significant piece of the requirements between customer and supplier. They have expanded well beyond the automotive industry and created a huge administrative bureaucracy of registrars, certification bodies and auditors as well as consultants to guide businesses to success. Amid the noise and continuing confusion in some quarters, quality management systems serve necessary and meaningful purposes and should serve as the foundation for business processes in the foundry.

The goal of this *AFS Silver Anniversary Paper* is to provide perspective on the history of the quality management system (QMS) and identify those enduring lessons that need to be heeded today. While the QMS of today reads quite differently than the QS-9000 of 1999, the factors of quality success for suppliers, whether automotive or not, have not changed—and are more vital in importance in 2024.

DEVELOPMENT OF QUALITY SYSTEMS

This concise examination of quality system development will first be introduced by describing the purpose of such systems. The historical flow of the QMS changes will then be observed, both within the automotive sector and the realm of manufacturing overall. Finally, with the historical framework established, the trends in this evolution can be noted. These trends should assist in providing some sense to these changes and offer clues about what the future might hold for suppliers.

ROLE OF QUALITY MANAGEMENT SYSTEMS

In order to grasp the purpose of quality management systems, it is necessary to define the terms in the context of a manufacturing organization.

Manufacturing organizations have an overriding goal of sustaining the business through achieving and maintaining profitability. Profitability has many contributors, but an essential element of profitability is the satisfaction of customers who purchase the products. This satisfaction is attained through an understanding of the needs and expectations of customers and a means of building these needs and expectations into the organization's processes and products. One role of any QMS is to obtain and understand customer requirements and integrate these into the business processes of the company.

A second essential element of profitability is to produce that which is needed to satisfy customers at a total cost that is less than the price customers are willing to pay for the product. An important role of a QMS is to drive the cost of producing goods downward through improvement activities.

Quality has then a definition appropriate to manufacturing: "Quality is conformance to requirements at a cost that the customer perceives as value." Management systems are the planned architecture of processes designed to accomplish the tasks of producing conforming parts and doing so while continually improving the processes and products.

It should be observed then that no organization is without a QMS, as all organizations are striving to stay in business through selling products to customers at a profit. The question for quality system development is this: "What are the components of a QMS that leads to effectiveness in accomplishing these business purposes?" This question has led to some diversity within various QEMs and an evolution in the nature of QMS requirements.

A related question regarding QMS has to do with the specificity of requirements; to what extent should customer interests override those of the organization in the construction of the QMS? These questions have been answered variously over the years and have led to considerable change in the world of quality and certainly in the limited scope of this paper to the automotive industry and its QMS requirements most notably initiated with QS-9000.

HISTORY UP TO QS-9000

Quality management systems, as can be seen by the enduring purpose of such systems, have had a long history. Formal contractual requirements for automotive quality systems trace their beginnings to at least the 1960s. Each automotive OEM developed requirements and formal means of communicating with the OEM that were unique. The OEM automotive manufacturers viewed their regulations and systems as a part of their intellectual property and a component of their competitive advantage over others in the marketplace. Ford, for example, developed its Q1 program to prescribe quality system requirements for its suppliers. GM utilized a program called "Targets for Excellence."

These early programs were administered by the OEM, and this included both the development and communication of requirements as well as the audit and ongoing monitoring of conformity.

The US Department of Defense, perhaps the largest original equipment manufacturer, had early recognized the need for a documented system to control quality of components and services provided by military contractors. The MIL-Q-9858 program was initially published in 1959 as "Military Specification: Quality Program Requirements."[3] A similar standard was developed in Great Britain that had widespread influence in the quality community; titled BS5750-1, it was published in 1979.[4] These early standards were the source material available when ISO developed its first International QMS in 1987 and were highly influential in the development of the first edition of ISO 9001.[5, 6]

Within the automotive sector, competitive pressure increased, especially in the mid-1980s as Japanese carmakers began to enter the market. There was a newfound interest in business improvement following Japanese and global benchmarking and the techniques of total quality management—and this placed a system approach at the forefront. Schonberger was an important and widely influential spokesperson of this linkage between business success and quality systems as observed in Japanese manufacturing methods.[7, 8]

By March 15, 1987, when the first ISO 9001 QMS Standard was published, the automotive industry was already discussing collaboration between the OEMs to standardize tools and techniques for their suppliers.

Suppliers were grumbling about the growing diversity between customer requirements and the frequency of audits, often to quite different criteria. It was not uncommon in the 1980s and 1990s for suppliers to staff full-time positions just to manage customer audit activity.

The initial efforts at standardization of quality expectations within the automotive industry focused on the tools and techniques of quality planning and assurance. These began to be produced by an industry work group composed of OEM and selected supplier representatives. Table 1 provides a summary of this work.

Table 1. Early Automotive Requirements Publications

Year of First Edition	Title
1990	Measurement System Analysis, MSA
1992	Statistical Process Control, SPC
1993	Potential Failure Mode and Effects Analysis, FMEA
1993	Production Part Approval Process, PPAP
1994	Advanced Product Quality Planning and Control Plan, APQP

The standardized methods became known in the industry as "the five core tools" and greatly influenced the practices of automotive suppliers, becoming the basis for practice in these areas even today.[9-13]

The success of the application of the five core tools and the resulting efficiency in suppliers' communications regarding quality encouraged further cooperation among the OEM community, at least those centered in Detroit, Michigan. The five core tools, however, are primarily utilized within the design and development process. While this is an important aspect of protecting supplied parts' quality, the production process and various support processes needed to be addressed if a full system of requirements for suppliers was to be established.

Fortunately, this system was readily available in the existing structure of ISO 9001:1987. The Big Three's work group borrowed extensively from ISO 9001:1987 while not quoting it directly. With the design and development process standardized in the Advanced Product Quality Planning and Control Plan (APQP) reference manual published in June of 1994, and with a recognized quality system at hand, it was only a few months later, in August of 1994 that the first edition of QS-9000 was published. One can see the clear correspondence between QS-9000 and ISO 9001:1987 in Figure 1.

An examination of the contents of QS-9000 reveals the challenges these OEM competitors experienced in developing system requirements. Each contributor retained "customer-specific requirements" which were exceptions or additional requirements to the QS-9000 Standard itself. In addition, QS-9000 included rules for certification and those registrars that would be providing audits to certify suppliers. QS-9000 embodied the five core tools as mandatory requirements.

QS-9000 was the automotive industry's effort to systematize and improve supplied quality and delivery performance. It was a huge step forward in standardizing expectations and formalized the quality function within automotive suppliers.[14, 15] It also began a systematic dismantling of what had been a significant segment of OEM operating cost: OEM Supplier Quality Departments. Thus, what had been a huge cost burden to the OEM became a supplier cost; suppliers were now responsible for getting themselves audited and certified to QS-9000. Registrars were acting, at the supplier's cost, as agents of the Big Three, reporting on the findings and enforcing their rules, including customer-specific requirements.

ISO 9001:1987 (E)		QS-9000:1998 (third edition)	
Section	Title	Section	Title
0	Introduction	Introduction	Goal
1	Scope and Field of Application		Purpose
2	References		Approach
3	Definitions		Applicability
			Implementation
			Quality System Documentation Progression
			Quality System Requirements Categories
4	Quality System Requirements	Section I	ISO 9000-Based Requirements
4.1	Management Responsibility	4.1	Management Responsibility
4.2	Quality System	4.2	Quality System
4.3	Contract Review	4.3	Contract Review
4.4	Design Control	4.4	Design Control
4.5	Document Control	4.5	Document and Data Control
4.6	Purchasing	4.6	Purchasing
4.7	Purchaser-supplied Product	4.7	Control of Customer-Supplied Product
4.8	Product Identification and Traceability	4.8	Product Identification and Traceability
4.9	Process Control	4.9	Process Control
4.10	Inspection and Testing	4.10	Inspection and Testing
4.11	Inspection, Measurement and Test Equipment	4.11	Control of Inspection, Measurement and Test Equipment
4.12	Inspection and Test Status	4.12	Inspection and Test Status
4.13	Control of Nonconforming Product	4.13	Control of Nonconforming Product
4.14	Corrective Action	4.14	Corrective and Preventive Action
4.15	Handling, Storage, Packaging and Delivery	4.15	Handling, Storage, Packaging, Preservation and Delivery
4.16	Quality Records	4.16	Control of Quality Records
4.17	Internal Quality Audit	4.17	Internal Quality Audits
4.18	Training	4.18	Training
4.19	Servicing	4.19	Servicing
4.20	Statistical Techniques	4.20	Statistical Techniques
		Section II	Customer-specific Requirements
			Chrysler-specific Requirements
			Ford-specific Requirements
			General Motors-specific Requirements
			Other OEM-specific Requirements
		Appendices	
		A	Implementation of the QS-9000 System
		B	Code of Practice for Quality System Certification Bodies/Registrars
		C	Standard Characteristics, Special Characteristics and Symbols
		D	Local Equivalents for ISO 9001 and 9002 Specifications
		E	Acronyms and their Meanings
		F	Change Summary
		G	QS-900 Accreditation Body Implementation Requirements
		H	QS-9000 Registration Audit Day Requirements
		I	Additional QS-9000 Registration Requirements
		J	Control Plan

Figure 1. This chart compares the contents of ISO 9001:1987 to QS-9000. ISO 9001's 20 element outline has been adopted almost verbatim into QS-9000.

HISTORY BEYOND QS-9000 TO IATF 16949

Prior to 1994, ISO 9001:1987 was a little utilized, voluntary guideline for the establishment of a quality system. Military contractors would be continuing to follow MIL-Q-9858 and its subsequent revisions through 1996. Other manufacturing segments either had no formal guidance or it was unique to individual manufacturers. All of that changed radically upon the adoption of ISO 9001:1987 requirements into QS-9000. The ISO 9001 registrations radically increased as the automotive industry modeled their hybrid approach to establishing a market segment's control over quality.

Figure 2 graphically illustrates the rapid and significant growth in ISO 9001 certifications following the 1994 release of the first edition of QS-9000.

This growth in the popularity of establishing quality systems on the basis of ISO 9001, and specifically international standards, was encouraged by the model of automotive standards but also by the general increase in customer expectations and global competition.

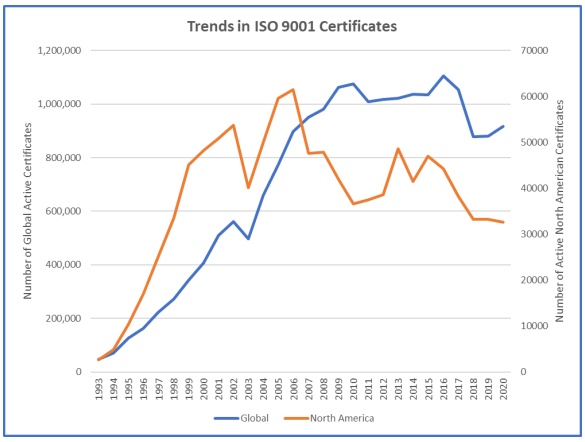

Figure 2. This graph provides information on the quantity of active ISO 9001 certificates for each year through 2020. The orange line represents the number of global certificates, the blue line shows the number of certificates in North America.[16]

The unexpected global utilization of ISO 9001-based quality systems following QS-9000 had dramatic consequences within the automotive industry. The Big Three no longer dictated what was normative for a working quality system. International standards development became the driving force for change, pushing automotive quality standards with it.

The third edition of QS-9000:1998, was its last. Automotive OEMs worked with the ISO Technical Committee 176 to create a document that would no longer be owned by the Big Three but have international appeal.[17] ISO/TS 16949:1999 was born. This standard adopted the ISO 9001 language directly such that certification to it would also be certification to ISO 9001. The requirements were no longer just a composite of Detroit-based thinking but incorporated sector-specific requirements beyond ISO that reflected European distinctives. The 1999 edition of ISO/TS (TS signifies a technical standard, one that requires a specific frequency of review) incorporated the 1994 revision of ISO 9001, only editorially revised from the original 1987 standard.

Yet even as the automotive world was adjusting to ISO/TS 16949:1999, ISO 9001:2000 was released, representing a significant change in structure, terminology and approach. The international community had redefined quality practice and the automotive community was forced to follow. It took time, but ISO/TS 16949:2002 was issued to incorporate the format and structure of the new ISO Standard.

The structure of the new standard was based on the concept that the entire organization needed to be engaged in the process of improvement and that improvement took the form of the Plan-Do-Check-Act cycle (PDCA) that is attributed to W. Edwards Deming and popularized by him and others through the international quality community.[18] The new structure of the standard was organized as depicted in Figure 3.

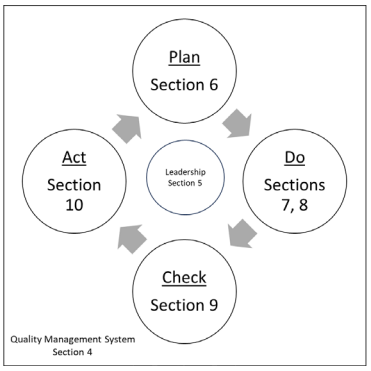

Figure 3. The diagram represents the PDCA cycle, the basis for ISO 9001:2000 and has continued to the present. The section numbers form the structure of the 2000 Standard.

This process model business operation as led by management planning, led to a sequence of activities to drive "product realization" supported by various functions (i.e., competence development, quality, production control) which led to measurement, analysis and improvement. A significant shift in thinking, not just in structure is present here: the activities themselves were always considered important, but now the relationship and hand-off between these functions was elevated in importance.[19] Audits could no longer be based on a checklist of documents or activities; audits needed to evaluate the functional relationship between processes for effectiveness. This marks an important step forward in the evolution of quality systems.

The ISO 9001:2000 revision was also notable for its streamlining of the structure of the QMS Standards themselves. In 1987, ISO 9001 was the full set of requirements for those manufacturers who had responsibility for design, development, manufacturing and delivery of product to the customer. ISO 9002 existed, a subset of the ISO 9001 requirements, for those that did not design or develop products. ISO 9003 existed, a smaller subset of the ISO 9001 requirements, just for those that handled product and delivered it to the customer (i.e., a warehouse). ISO 9000 described this structure and provided terms, definitions and scope of application information. An organization could be certified to ISO 9001 or 9002 or 9003 prior to the ISO 9001:2000 revision. This structure continued in the 1994 edition of ISO 9001. In ISO 9001:2000, organizations simply declared exceptions in the scope of their operations and were certified to ISO 9001 alone; ISO 9002 and ISO 9003 were obsoleted.

By 2008, ISO 9001 was again significantly revised, not in structure but in content. By 2008, the world had been rocked by the terrorism of 9/11/2001 and the war on terror. This and other factors led quality thinkers to consider manufacturing from a risk management perspective, reflected in additional requirements for planning and an assessment of risks and opportunities facing the organization.

The 2008 revision of ISO 9001 also saw increased emphasis on the "process approach" with its focus on the inter-connected nature of business activities and the need for process ownership and adequate resources to fuel process success. Audits were to be conducted by identifying the aspects of a process noted by the legs, head and tail of the "turtle diagram" as shown in Figure 4.

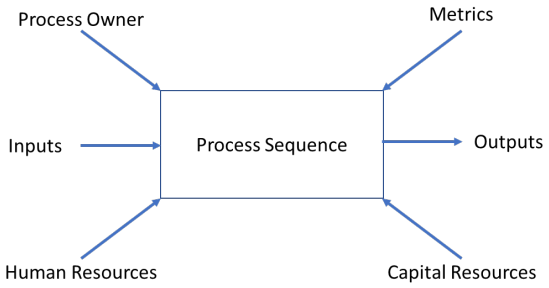

Figure 4. This figure illustrates the "turtle diagram." The metrics expected to be monitored were to include both efficiency and effectiveness measurables. The need to identify a process owner, responsible for the factors of success was emphasized. The supplier-customer relationship between various processes was also emphasized in the ISO 9001:2008 Standard.

The ISO/TS 16949:2009 revision readily adopted the 2008 changes in ISO 9001. These changes strengthened the automotive industry's existing perspective on risk and its need for results, not just documented systems. Efficiency measurement of processes helped put a spotlight on factors that affected cost, always an interest in the competitive automotive market.

BEYOND ISO/TS 16949 TO TODAY

ISO 9001 was modified again in 2015, with a series of primarily editorial changes intending on making the language more generic and yet also more amenable to be the foundation for many sector-specific quality management systems. Medical, aerospace, rail, telecommunications and food production are just some of the manufacturing sectors that produced QMS Standards based on ISO 9001 over this period.

The 2015 revision of ISO 9001 generated a corresponding change in the automotive sector's quality management system. Largely as a result of pressure to incorporate more and more of the formerly customer-specific requirements to the standard, and with broader participation from many OEMs in Europe, Japan and Asia, the International Automotive Task Force (IATF) decided to create its own standard, as a "supplement to and used in conjunction with ISO 9001:2015."[20]

This change formally separated the text of IATF 16949 from the oversight of the ISO organization. Users must purchase both the IATF Standard and the ISO 9001:2015 Standard and adhere to both, unless the IATF Standard overrules the ISO 9001 requirement. It is interesting to note that while this change permits IATF independent authority over its standard, the text of the standard assures the user that, "The IATF maintains strong cooperation with ISO by continuing liaison committee status ensuring continued alignment with ISO 9001."

The current standard of IATF 16949:2016 has incorporated several former customer-specific requirements into the requirements for all suppliers. Perhaps most significant of these include:

- A requirement for a warranty management process.
- A significant, extended section describing requirements for the assurance of product safety, including validation of embedded software.
- A requirement for the inclusion of a matrix. demonstrating that all customer requirements are identified and find a place in the documented QMS.
- Specific controls over temporary process changes.
- Clarification of responsibilities between rework and repair.
- Strengthened controls over error proof devices.
- More specific inputs into both the process control plan and the product design process.

It has been a long time since the last revision of the IATF Standard, nine years as of this writing. IATF has established a system of updating the content of the standard without the lengthy committee and consensus building process of formal revision. This system allows for the periodic publication of "Sanctioned Interpretations" which, in response to an inquiry, expand on the content or otherwise modify the intent of a specific section of the standard. For example, with the increased concern over cyber security within manufacturing as a whole, and the automotive industry specifically, added requirements for security systems, testing and education were addressed through sanctioned interpretations. As of May of 2022, the most recent revision as of the submission of this paper, 25 changes were published.[21]

Despite the increasing specificity of the requirements, automotive suppliers must still review and incorporate customer-specific requirements for each customer subscribing to IATF 16949. These requirements are helpfully provided on the IATF website and are updated regularly by the OEMs.[22]

The year 2015 also brought about the significant technical revision of ISO 9000, the document now capturing the core principles providing the philosophical foundation for ISO 9001. This international standard had not been revised since 2005 and provided strong affirmation for the continuing reliance on 7 basic principles underlying good business practice as established in the ISO 9001 Standard.

These seven principles are worthy of study and reflection by the student of quality. These are:

1. Customer focus
2. Leadership
3. Engagement of people
4. Process approach
5. Improvement
6. Evidence-based decision making
7. Relationship management

ISO 9000:2015 also was rewritten to include many more technical terms and definitions, along with a better organization of the terms.[23] This extended history of automotive quality systems can be viewed as a whole in timeline format in Figure 5 (located at the end of this paper).

ABIDING THEMES OF QUALITY SYSTEMS

Having endured even the brief summary of the various changes and evolution of automotive quality management system requirements, it is important to draw out a few enduring principles that have remained both useful and directly relevant to success in the automotive market. These principles have been a constant throughout the various changes and have revealed themselves as having enduring value.

PDCA FUNCTIONALITY

The basic principle of learning, improvement and growth is the closed feedback loop. The scientific method is an expression of the same concept. Each step of production and each step of product design must incorporate a check and act step with a link to the next plan and execution. Performing operations of any kind without monitoring or measuring results is both naïve and risky; identifying issues in such monitoring and measurement without taking appropriate, effective action is both wasteful and demoralizing for those who do the work as well as those that check it. Confirming there are no open issues as a process proceeds to the next step is a bedrock principle of effective operations. The PDCA process was chosen as the structure of ISO 9001 for the simple reason that it is the most fundamental expression of how quality (conformance to requirements) is achieved.

LEADERSHIP AS CHANGE AGENCY

While the name has evolved, from "top management" to "leadership" over the years, the executive function has always been considered the primary driver of change that leads to improvement in the organization. This has been expressed in the QMS as "commitment" but has been defined in terms of how the commitment is to be demonstrated. All the way back to QS-9000, this highest level of management has been responsible for a series of actions that continue to be central to the achievement of excellent quality performance. These include:

- Communication of values through the establishment of policy that guides attitude and behavior in the organization.
- Allocation of resources in alignment with the policy priorities.
- Assignment of responsibilities to delegate authority for the accomplishment of the priorities.
- Review of progress toward objectives and action-oriented decision making to support progress.

Indeed, it has been argued successfully elsewhere that the role of top management is central to the success of the enterprise in dimensions beyond quality performance, including safety and environmental.[24,25]

This is embedded in ISO 9001:2015 and in the fundamental principles of business management described in ISO 9000:2015. These form the basis for management systems of all kinds in the ISO Standard harmonized structure as described in ISO directives and Annex SL.[26]

INTEGRATION OF BUSINESS PRACTICES WITH QUALITY

Since the first ISO Standards were prepared, and certainly since the automotive industry began establishing its own standards, quality has been viewed with a holistic perspective. This was a primary element of the quality "gurus" such as Deming and Juran, early and highly influential voices in the automotive quality field. Quality is holistic in that quality principles and the achievement of quality were applied to the whole of the organization, not just to a quality department or quality function. This was recognized in the QS-9000 Standard; indeed, a business plan was required, and specific aspects of the plan were required to demonstrate that management was linking quality throughout the organization. This integration was also a recognized principle of quality management having a long history even by 1999.[27-29]

While often referred to as "Total Quality Management" (and at times TQM was maligned as a fad program of the late 80s and early 90s), the key concepts have been retained for their utility. These have been more explicitly expressed in quality management system standards over the years while dropping the TQM moniker. The concepts include:

- The alignment of business objectives as quality objectives
- Seeing all business processes as subject to the same requirements as those in the production stream
- The required engagement of all people in the company in quality pursuits with motivation, awareness and competence
- Seeing all business processes as an interconnected series of processes (the process approach, as pictorially represented as the turtle diagram)
- The application of traditional quality tools to all business processes

THE NEED FOR A QMR

In QS-9000, (Section 4.1.2.3) it was required that executive management appoint a member of management defined authority to ensure that a quality system is established, implemented and maintained in accordance with the standard and for reporting the performance of the quality system for review and as the basis of improvement. This individual was referred to as the quality management representative, or QMR.

The QS-9000 Standard acknowledged that some individual needed to champion the cause of quality and the quality system within the organization. This person was tasked with the initial responsibility to set up a conforming system of requirements and the continuing role of maintaining the system and reporting on its performance. Subsequent automotive quality systems have only added to this person's duty, for example they also have the duty to interface with outside registrars to maintain certification under current requirements. This identification of a management representative is an expression of appropriate delegation practice, but it is also a recognition that one individual needs to lead this effort. This individual needs to be properly equipped for this role and cared for properly, given the significant responsibility they bear. It should also be noted that the standard requires that they be given the degree of authority necessary to carry out this role, both initially and on a continuing basis to maintain the system and report performance effectively.

ENDURING LESSONS FOR FOUNDRIES

QMS MUST BE VALUE-ADDED

The quality management systems for the automotive sector have certainly changed over time. They have adapted to changing internal factors as the automotive world has responded to changing circumstances. They have also been subject to external factors—and perhaps a bit of political pressure—that has not always been directly useful. Auditing and consulting are big business, and this has not always led to the best image of the quality profession, let alone quality standards themselves. These impacts are shown in Figure 6 (located at the end of this paper).

Despite the tarnish that may have diminished the luster of automotive quality system standards, the essentials have been retained. The core principles of quality improvement and effectiveness at customer satisfaction are still primary aspects of these standards. The question is whether the foundry will choose to treat these requirements as an external add-on, as a license that must be earned and hung on the wall and forgotten about. Will the foundry take that which is at the core of the standards and embody them in the business itself so that they enable the foundry to perform better than it would otherwise?

Figure 6 describes the current situation: quality systems are now either part of the culture of the company or they are administrative waste. Half-hearted conformity under the current system of external audits is quickly subject to formal corrective actions and expensive re-audits and other severe penalties in both time and money. There is no rational middle ground.

Full, whole-hearted adoption of these systems yield substantial fruit in improved performance and a unified system of management that easily adopts environmental requirements and safety responsibilities. Good management supports improvement of each of the organizational obligations.

QUALITY SYSTEM IS MORE THAN PRODUCT QUALITY

Within foundries it is common for the facility metallurgist to be responsible for quality in the plant. The head of quality for a plant should certainly know about the company's production processes and products. They should know the critical characteristics of both processes and products and understand the tests, measurements and monitoring activity of the site.

The head of quality in the foundry must also be extremely knowledgeable about the business processes of the facility, from HR to purchasing to maintenance. They must understand the quality system requirements as found in ISO 9001 and IATF 16949 and how each "shall" requirement is accounted for within the company's QMS. They must be able to not only have responsibility and authority for maintaining the QMS, but also be in a position to capably report to leadership the performance of the QMS.

The foregoing description of the QMR does not necessarily eliminate the plant metallurgist from consideration for this role. It does, however, indicate that the skills and training required to be a competent metallurgist is not all that is required from a QMR. This is true regardless of the size of the foundry.

LEADERSHIP

If the history of the quality system requirements is any indication, effective leadership is needed more than ever in the foundry. Effective leadership in this context is found in an individual who is led by values and consistently models them. An individual who can apply these values to the local situation, enabling others to see the vision of what benefits would be accrued if these values were effectively implemented.

Furthermore, leadership manifests itself in charting a course toward that vision, fully utilizing the principles of quality improvement and engaging associates at all levels to contribute. This is leadership in the quality management systems. Leadership is not charisma or a certain style of persuasion or formula of the business particulars. Leadership demonstrates its commitment to the foundry and to its people by a consistent application of company values to the challenges the actual conditions in the market reflect. Leadership exhibits excellent eyesight of the problems that exist but also of the people that will be needed to solve them.

There is no shortcut. No external audit and no piece of paper can confer leadership—no single metric can be used to measure its progress. Yet in the long term, every successful foundry is the result of effective leadership. The QMS Standards have only tried, in their own limited way, to prescribe practices that are consistent with good leadership. Just as morality cannot be legislated, good leadership cannot be created from a list of requirements. Yet ignoring these tested and longstanding requirements is a clear sign of arrogance or ignorance.

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OVERSIZE FIGURES & TABLES (NEXT PAGE)

OVERSIZE FIGURES & TABLES

DESCRIPTION	STANDARD	HISTORY									
		1987	1994	1999	2000	2002	2005	2008	2009	2015	2016
Guidelines for Use of the ISO 9000 Family of Standards	ISO 9000	Initial Edition	Minor revisions		Provides definitions and framework for QMS principles		Updates to utilize process approach and risk-based thinking	Minor updates to reflect ISO 9001:2008		Added key QMS management principles and fundamental concepts	
Requirements for Design and Production of Products	ISO 9001				Becomes a single standard, allows for exclusions for those previously subscribing to ISO 9002-9003		NO CHANGE	Updates to utilize process approach and risk-based thinking, adopts more automotive requirements		Added organizational context and needs/expectations of relevant interested parties	
Requirements for Production and Installation	ISO 9002				DROPPED						
Requirements for Final Inspection and Test	ISO 9003				DROPPED						
Quality System Requirements applicable to Ford, GM, Chrysler	QS-9000		Initial Edition	Obsoleted (third edition)							
Quality System Requirements applicable to Automotive Customers	ISO/TS 16949			Initial Edition		Second edition incorporates the radical changes found in ISO 9001:2000			Third Edition includes the changes made to ISO 9001:2008		Obsoleted
Quality System Requirements applicable to Automotive Customers	IATF 16949										Initial Edition, incorporates ISO 9001:2015 by reference, expands the level of automotive detail

Figure 5. A timeline reflecting the revision history of relevant automotive quality management system standards.

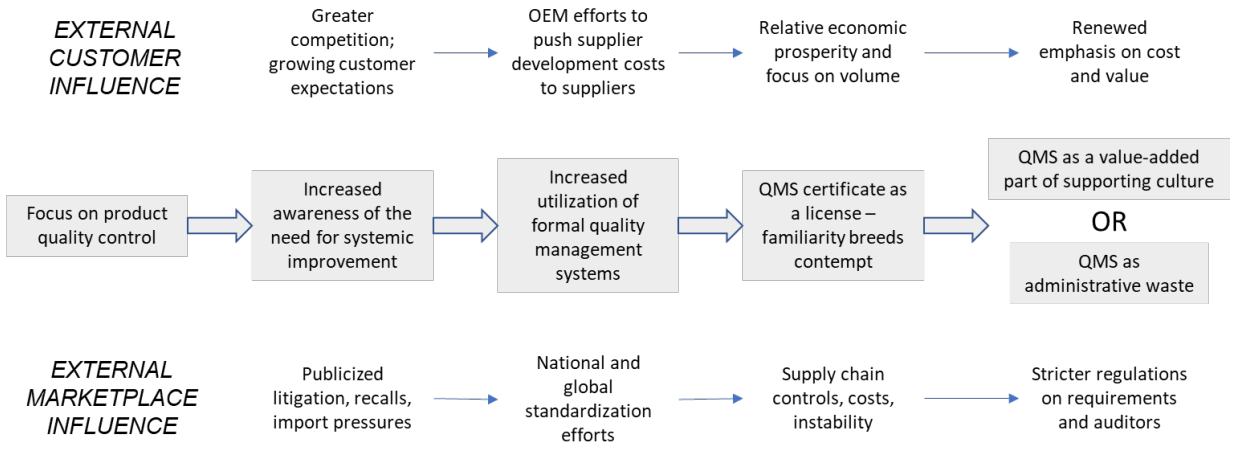

Figure 6. A chart of factors influencing automotive quality management systems over time is provided.