

# **Extending Quality Culture in the Digital Age**

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## **Abstract**

Industry 4.0 provides many unique challenges for business leadership. The volumes of data availability reside in numerous locations, which were not even in existence a decade ago. The affordability of huge data storage and the new techniques of gathering data are resources that are in the nascent stages of development. Within this new data frontier exists the human element of the business world. Automation and artificial intelligence have replaced many repetitive jobs, while the need for knowledge workers continues to develop. The opportunities to apply innovation through the analysis and application of data are limitless. Leadership must provide a method for taking advantage of the data, while developing their employee's skills to become knowledge workers. This transition of employees to knowledge workers can be accomplished by specific application of several elements of the existing Quality Body of Knowledge. A knowledge worker, as a member of a high performing team, is able to provide contributions to companies in their pursuit of organization excellence.

## **Keywords:**

Leadership, teamwork, quality processes, organizational excellence, big data.

Extending quality culture in the digital age provides unique opportunities to apply the tools and concepts of quality to non-traditional situations. In these non-traditional situations, the human aspect of quality extends beyond the walls of business and can be utilized to support activities that enhance our personal lives and the lives of those around us. The digital age has experienced the entrance of the Millennial generation of highly educated and technically competent professionals in all industries. This generation has developed a strong affinity for the gathering and application of data to situations in both their personal and professional lives. The analysis of the volumes of data available to support business decision making is overwhelming. Millennials must develop their skills in performing data analyses as a routine process to provide the leadership of contemporary businesses with the facts and options available to make informed business decisions. Millennials are being called upon to address the importance of organizations' and their employees' contributions to the communities and societies in which they live. Of course, this line of thinking necessitates a thorough discussion of the ways in which quality can meet the goals of both business and society by combining their mutual interests and by blurring the boundaries that exist between them. To that end, this paper addresses how leaders can develop high performing teams of employees by applying basic quality tools in their role of supporting the improvement of the knowledge process within a company.

Big data is the driving force behind contemporary business in this age of Industry 4.0. The Internet and the explosion of social media are disrupting the planning and operations in almost every type of industry. Basic questions require new and innovative answers. How can business remain current? Moreover, how can business be proactive in planning for the future? This data invasion can provide business with new and unforeseen opportunities as they develop their future strategies, as well as continue to manage their routine processes effectively and to maintain customer satisfaction. But, where do we begin? And, of greater importance, how do we begin? These basic questions need to be addressed in order to develop a plan for exploiting the opportunities provided by big data.

The elements necessary to provide effective planning for capitalizing on the data opportunities reside within the current Quality Body of Knowledge (QBOK). Many of the basic tools, elements of leadership, team building processes, and the ability to recognize how to utilize existing knowledge management are four of the key topics that support change. To be effective in this regard, company leadership must view quality from the perspective of

organizational excellence. In manufacturing, quality has evolved from an “after the fact” process required only to stabilize production so a consistently acceptable and improved product is created to a key element of the ongoing manufacturing process. Many companies continue to apply quality as a product related function. Although the need for the traditional product focus of quality continues to be important, the application of quality tools and methodologies throughout the company in support of organizational excellence provides opportunities such as the utilization of big data for gaining competitive edges in their markets.

Before we begin to examine quality from the organizational excellence perspective, a clear understanding of Industry 4.0 is necessary. One of the most comprehensive and commonly used definitions of Industry 4.0 is: Industry 4.0 is the name given to the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing. It must be understood that what is being discussed here is not an extension of Industry 3.0. It must be thought of as a separate and distinct event. Industry 4.0 is the fourth industrial revolution (Schwab, 2016).

The evolution of industrial development is displayed in Figure 1. shown below. In each phase, quality has been a reactive activity meant to bring stability and consistency to the products resulting from each phase of this evolution. By this point in time, quality practitioners should have acquired adequate historical data from previous studies and the development of advanced quality tools and methodologies to implement proactive activities into existing processes, as opposed to taking a reactive stance related to market changes.

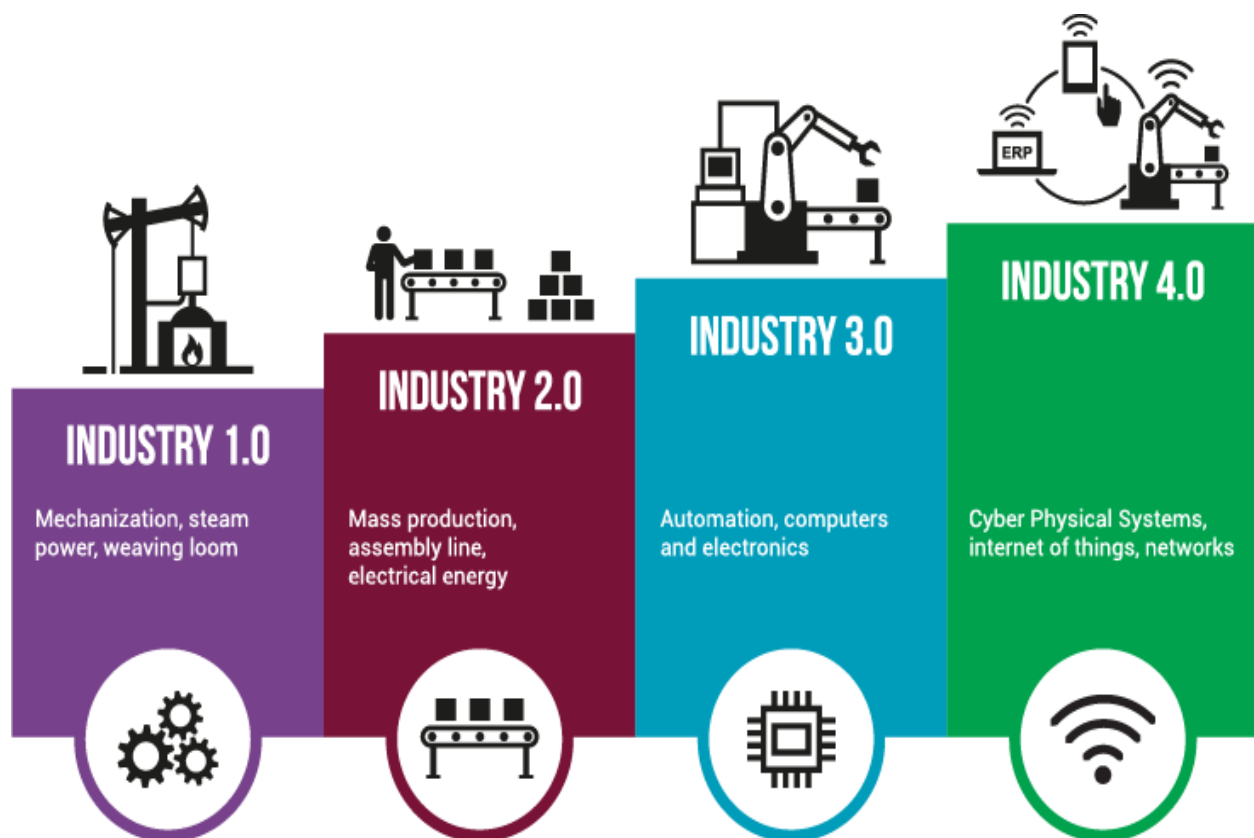


Figure 1. Evolution of Industrial Development

Brodsky (2003) reminds us of a long-standing rule of business that suggests you are either an agent of change or you are destined to become a victim of change. You simply can't survive in the long term if you are standing still. This sentiment remains more relevant to the business world today than it ever has in the past.

Many experts and analysts agree that Industry 4.0, as the next phase in the digitization of the manufacturing sector, is driven by four disruptions. They are: the astonishing rise in data volumes, computational power, and connectivity, especially new low-power wide-area networks; the emergence of analytics and business-intelligence capabilities; new forms of human-machine interaction such as touch interfaces and augmented-reality systems; and improvements in transferring digital instructions to the physical world, such as advanced robotics and 3-D printing.

The first two disruptions presented above, data volumes and the emergence of analytics, apply equally well to service related industries. This overwhelming number of activities, along with the routine process transactions, can be confusing. Additionally, the time and resources required to address current needs, as well as the effective planning for the future, are constrained. These constraints must effectively be managed to maximize development of the opportunities presented by the rise in existing data. The methodology to make this happen resides in the application of elements of the QBOK.

The groundwork for dealing with these disruptions is currently being addressed by quality professionals. For example, Radziwill (2018) discusses the 4<sup>th</sup> Industrial Revolution and introduces Quality 4.0 tools:

- Artificial intelligence: Computer vision, language processing, chatboxes, robotics, etc.
- Big data: Infrastructure, easier access to data sources, analyzing large data sets, etc.
- Blockchain: Increasing transparency and auditability of transactions, etc.
- Deep learning: Image classification, complex pattern recognition, text generation, etc.
- Enabling technologies: Cloud computing, data streaming, 5G networks, etc.
- Machine learning: Text analysis, spam filters, fraud detection, forecasting, etc.
- Data science: Bringing together heterogeneous data sets to make predictions, etc.

In addition to the introduction of new quality tools, Radziwill (2018) proposes a new role of quality in alignment with the evolution of quality. The progressive view of the role of quality is stated as such:

- Quality as inspection: Early days involved inspecting bad quality out of products
- Quality as design: Deming's recommendation to cease dependence on inspections
- Quality as empowerment: TQM and Six Sigma advocate a holistic approach
- Quality as discovery: To discover and aggregate new data sources in an adaptive environment

The importance of the human element has long been a critical factor in developing high levels of organizational performance. In the last two decades of the twentieth century, Deming noted the importance of the psychology of people and the application of knowledge (Orsini, 2013). Current publications continue to address the importance of the human element with regard to issues of big data. Accordingly, Maisel and Cokins (2014) state, "More and more organizations are seeking better processes and tools to ensure that the right people have the information at the right time to make smarter decisions" (p. 22). These are but two of the many views that reflect a common and often overlooked element: people. People remain an integral part of the Industry 4.0 evolution.



Figure 2. System of Profound Knowledge

Figure 2. represents Deming's System of Profound Knowledge (1986). His model includes four stages: appreciation for a system, understanding variation, theory of knowledge, and psychology. These are important factors to be evaluated in the development of Knowledge Management (KM). Deming wanted to emphasize that most organization processes are cross-functional. That is to say, parts of a system must work together, every system must have a purpose, and management (leadership) must optimize the system as a whole. This concept reinforces the importance of human factors in a high performing organization.

While Deming emphasized the importance of people in his quality theories, he was not alone. Drucker, a Deming contemporary, also stressed the importance of contributions of humans in many of his research publications. Drucker recognized that the evolution of technology was becoming a dominant factor in business for the 21<sup>st</sup> century, but he viewed the human contribution as equally necessary in statements such the following quotation, "The most important contribution of management in the twentieth century was the five-fold increase in the productivity of the manual worker in manufacturing. The most important contribution management needs to make in the twenty-first century is similar to increase the productivity of the knowledge work and the knowledge worker" (Edersheim, 2007, p. 5).

The knowledge worker and technology were both required to utilize the volumes of data available to support fact based decisions. The future was unclear, but it was evident that decisions were necessary for a business to survive. When the journey to the future is not clearly evident, but the necessity to take this journey is evident, some risk is associated with organizational decisions.

Kotter (1996) explains the difference between management and leadership in this way: Management produces a degree of predictability and order and has the potential to consistently produce short-term results expected by various stakeholders, while leadership produces change, often to a dramatic degree, and has the potential to produce extremely useful change. He further states: Managing change is important. Without competent management, the transformation process can get out of control. But for most organizations, the much bigger challenge is leading change. In fact, the current ISO 9001:2015 has shifted its focus from manager to leader. National quality awards, such as the Baldrige award in the United States, also focus their attention on leadership. Developing the human capital of a company requires leadership. Human capital development cannot be managed. According to Drucker, "Knowledge can't be taught, but it can be learned" (Edersheim, 2007, p. 198). Leadership is a critical element of the current QBOK.

To create a successful plan for the future that applies KM an element of the current QBOK, to the efficient utilization of the knowledge worker and big data, real learning must be applied. Organizations should realize that KM is about people, behavior, and culture rather than about technology, but technology can be a powerful enabler to make KM effective in maximizing its results (Hariharan, 2016) Real learning goes to the heart of what it means to be human and develops human capacity to create the future. This process is commonly referred to as innovation. Innovation is one of those trigger words. When managers hear this term, they become defensive because for them, innovation involves risk. Risk is a condition that management would like to avoid or at least minimize. Risk resulting from human actions or ideas can be especially of concern because of the subjective nature of human related risks. Drucker recognized these concerns but stated that "we cannot survive without taking some risks" and "managers need to move forward while taking the right risks, not necessarily the least risk" (Edersheim, 2007, p. 212).

In Deming's words, there is no substitute for knowledge and information is not knowledge (Orsini, 2013) Moving forward in the digital age of Industry 4.0 is where quality can be supportive in making fact based decisions which combines the knowledge worker and big data into the KM process of a company. Tenner (2018) states, "Technology advocates may disdain that culture and proclaim themselves transhumanists who are better culture through blurring the line between humanity and technology" (p. 128). He is using the term "transhumanist" to describe this KM process. KM requires several elements for successful application. First, an awareness of the value quality, as a methodology that utilizes tools and techniques to support paradigm improvement, can provide to a company. Second, communications from leaders and human learning that quality is not a technique to assure product integrity. There must be an openness to accept change as an integral part of the internal company culture. Embracing new and innovative "outside the box" ideas and concepts without fear and accepting that some degree of risk may be involved.

The greatest challenge in successful acceptance in recognizing these four elements of the QBOK: leadership, team building, knowledge management, and quality tools reside with the implementation of organizational change and the impact of this change on the human element within the organization. The human side of change must be approached with effective and efficient utilization of its core processes. The foundations of processes exist with the people, who are the basis of the company's culture. Culturally shared values can powerfully influence human behavior, because it can be difficult to change, and because its near invisibility makes it hard to address directly. Generally, shared values, which are less apparent but more ingrained in the culture, are more difficult to change than norms of behavior (Kotter, 1996). A key objective of the people and knowledge strategy is to ensure that you maintain and build your core capacities while being strategically adaptable.

A company must understand and communicate to its employees that technology will not replace the human element of core processes. Identifying the core processes of a company requires a structured approach involving a team of internal subject matter experts. Within every company, there resides a group of people doing the work. No one knows the internal workings of the company better than this group of Subject Matter Experts (SMEs). The application of various subjective quality tools, applied by a skilled facilitator, can develop this group of internal SMEs into a high performing internal team with a common objective of achieving a specific result of benefit to the company. The basis of applying subjective tools and then using quality techniques to quantify these subjective thoughts and ideas assures that all group members are heard and afforded equal consideration is the basis, or forming stage of a team. As additional meetings take place on other topics, this group gradually evolves to a high performing team within the company and their teamwork extends into the daily job functions. Team building is another element of the QBOK.

Applying several quality tools in the paradigm improvement format, not product improvement format, will realize fact based results and build strong internal leadership and cross-functional teams. These teams, with skilled facilitation from professionals who understand and apply the traditional quality methodologies in this Industry 4.0 environment can produce exemplary levels of KM performance.

A significant amount of attention has been devoted to quality methodologies. At this time, some additional discussion in this area is valuable. Quality methodologies, along with the traditional basic tools of quality, provide proven techniques for analyzing data, building teams, and addressing fact based decision making in support of operational processes, which have been described as paradigm improvement techniques. Quality, since the industrial revolution and through Industry 1.0, 2.0 and 3.0, has been a reactive element applied to products and product realization processes to improve product performance. Quality professionals have been restricted in applying their skills by siloed thinking in companies that have not recognized the evolution of quality from a reactive process to a paradigm improvement technique. They fail to see the numerous ways these tools and methodologies can develop the KM of a company to become proactive in capitalizing on the opportunities available in Industry 4.0. Leaders in any type of organization need to understand the internal process value quality can provide a company.

Success in Industry 4.0 requires that people remain an integral part process element. Data collection is virtually unlimited, but people have a capacity limit. There needs to be a reasonable balance maintained to prevent data overloads. Various quality tools such as a Failure Mode Effect Analysis (FMEA), multi-voting, affinity diagrams, and prioritization matrices can help establish risk levels, priorities, and assist leaders with fact based decisions in order to keep this balance, while continuing to further develop the KM of a company. The tools identified above represent only a small part of the extensive list of proven quality tools which can be applied in most every area of business processes. Quality professionals in their paradigm improvement activities need to be involved to assure that a balance is maintained between the data collection and the human element needed to analyze the data and make informed process based decisions.

Companies will continue to manufacture products that perform as they are intended. New technologies and products will continue to be developed and quality, in the traditional sense, will maintain its traditional role. The QBOK provides a foundation for analyzing data and developing human capital to support innovation with existing facts for taking a proactive role in leading companies through Industry 4.0 in the 21<sup>st</sup> century. This paper is intended for leaders who want to be proactive in cultivating an internal culture where data and the human element coexist in a culture supporting change. The change of customer needs; the change of environmental needs; the change of societal needs; and how the company accomplishes satisfying these needs resides in the application of quality tools and techniques.

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## Biography

Milton Krivokuca is Chair Emeritus of the Master of Science Quality Assurance program at California State University Dominguez Hills, Carson, CA. He has also taught Master's classes in critical thinking and quality theories at California State University Fullerton, Illinois State University, Meta Business School, University of California Riverside, INSEEC University Paris, and University of Redlands. Additionally, he has presented papers in Viet Nam, Jamaica, Hong Kong, Trinidad, China, Morocco, Saudi Arabia, Kuwait, Ghana, Nigeria, and the UAE, as well as countless locations throughout the United States and Canada. He is also a contributing author and subject matter expert for content in the 4<sup>th</sup> edition of the CMQ/OE Handbook, past chair of American Society for Quality Quality Management Division, and an ASQ Fellow, as well as a subject matter expert and curriculum developer for the ASQ's training courses. Dr. Krivokuca's advanced degrees include an MA, MBA, and a DBA. His professional certifications include: CMQ/OE, CQA, CQT, CQPA, CCT, CQE, CSSGB, and CSSBB. Currently, Dr. Krivokuca is president of Milton Krivokuca and Associates based in Wilmington, NC, USA