International Academy for Quality

IAQ Statement on Quality 4.0

Defining Challenges for its Incorporation and Deployment

Quality 4.0 as a Concept for Investigation:

The purpose of this statement is to summarize the current state of understanding of a topic that is gaining traction in the global quality community: Quality 4.0. This statement provides an initial point of departure for a newly formed Think Tank that is dedicated to investigating this topic.

The idea and naming of Quality 4.0 originated as an extension of the Industry 4.0 strategic initiative first adopted as an action plan by the German government in 2010. This term was first used in 2017 and applied to indicate that there is a new epoch of quality thinking that arrived as a result of the disruptive effect of digitalization and Big Data on the practice of quality in industry and society. Before this term was created the concept of quality had not been segmented into epochal periods based on advances in momentous events its own field. Thus, the prior epochs defined for quality were imprinted on the prior periods of Industrial Revolutions.[1] However, quality thinking has been evolving ever since the development of the control chart by Walter A. Shewhart in the 1920s.[2]

The current digital disruption and industrial transformation was also one of the outcomes forecast in an ASQ Future Study scenario in 1998.[3] Less than a decade later a digital transition of analog production systems and business models had been to a large extent achieved by 2008. However, at that time its acceptance was mostly engaged by major corporations and the benefits of the digital technology were not yet exposed broadly across all industrial sectors and societies.

With the progress of another decade, the coronavirus pandemic that started in late 2019 greatly accelerated industry's reliance on digital technology and stimulated a widespread accelerated acceptance of further digital transformation to take place worldwide, and stimulated a widespread acceptance of remote working based on digital communication technologies such as Zoom, MS Teams, Google Hangouts, as well as online learning that was accessed through an ever-broadening set of channels. In the first half of 2020, interest in digital applications grew by three-fold according to a recent McKinsey study.[4]

Thus, it was also a natural result for professionals in all disciplines to consider what these rapid transformations in ways of working may imply for the future of work, organizations and societies, and what may be the resultant consequences for their professional communities. McKinsey referred to this new age as "Smart Quality" and offered their own view on what it would entail which was limited to a great extent to reducing cost of poor

quality and recovering cost of bad quality from suppliers through digitized restitution processes as this would also reduce warranty costs.[5,6]

Quality 4.0 was picked up as a theme in conferences conducted by the American Society for Quality in 2017 and became the core theme of a Quality 4.0 Summit that has been held each year since then. Articles on this subject have dominated publication space in many quality-related professional magazines and academic journals are now also beginning to discuss this topic to develop its theory from different perspectives.

It is important to remember that Quality 4.0 emerged out of practices which mainly came from external sources such as advances in artificial intelligence, machine learning, big data, microelectronics, control theory, production engineering, information technology, adaptive robotic control, digital sensors, neural networks, and communications technology. Applications of these novel technologies in systems that conduct the routine quality tasks in the productive systems of organizations has led some to conclude that Quality 4.0 would become "hygiene quality" and conducted remotely by automated systems which would replace workers in this field. This perception is quite limited, but also widely-held and creates a number of issues which must be taken into account by the professional community.[7]

Properly understanding this background is quite important to appropriately deal with the main challenges ahead and identify the main Quality 4.0 features that need to be accounted for in developing an adequate operational definition and understanding the links among the methods and concepts that comprise it.

Issues Regarding the Current Disruption:

It is clear that digital technology will also be highly disruptive to the quality community as it has already been in many applications where it totally disrupted entire industries. It has long been known that a poorly informed supply chain leads to inventory glut and inefficiency by the imposition of a bullwhip effect of unbalanced flow information.[8] However, the total disruption of quality will most probably not be a universal outcome from the adaptation of digital technology for many reasons. In the first place, complete digitalization of a business requires significant capital investment, as well as capability development and this may be beyond the potential of many Micro-to-Small-and-Medium-Enterprises (MSME) to afford.

Since between 70-80% of the enterprises in most nations fit this profile, this means that there will remain a demand for non-fully digitized production and operations systems. When these businesses do invest in digital technologies it will most likely be to avoid pain-points in key bottlenecks or production capabilities that are required to maintain competitiveness. Such selective investment will not create a wholesale shift in the quality system but will most probably create a "point solution" that becomes grafted onto the current existing systems. Furthermore, in businesses that are not capital-constrained or where technology costs reduce significantly to a point of general affordability, the adoption of these new digital technologies will probably occur through a pattern of sequential investments based on favorable financial return-on-investment criteria.

Digital point solutions will create a problem for quality professionals that do not make the

transition to a digital sensor, Big Data, artificial intelligence world as there is a threat of replacing all human analytics in this loop with digital monitoring, processing, and adaptive feedback solutions, as well as by other emerging professions such as data scientists. If this occurs through a sequential adoption of digital technology then this "soft approach" will enable quality professionals to learn as they change. However, if this adoption occurs in an abrupt shift or "hard approach" then quality professionals may find themselves redundant or obsolete if they are not capable of contributing in this newly digitized world or they have not obtained the necessary skills and competence.

There is still a great deal of uncertainty in this disruptive epoch of Quality 4.0, and therefore it is imperative to become clear as the community faces this future as to what it means, what it implies for their careers, and what principles should be followed in the adaptation of these technologies in reengineered operational quality systems.

The International Academy for Quality (IAQ) recently has established a Think Tank to help make better sense out of this situation. Its first contribution to the current Quality 4.0 dialog is this definitional statement and principles observed which it offers as guidance to the global quality community as a starting point in its investigations.

Statement on Quality 4.0:

Quality 4.0 is an era of exceptional disruption to the practice of quality management in all of its dimensions of application. Expanding global challenges, shifting organizational priorities, and rapidly expanding technological capabilities are driving an acceleration of the changes that were already accelerating over the prior decade. Coping with both the organizational and human implications of this change represents the most significant challenge to those in the current community of quality professionals.

Today, there is no clear guidance about the way to approach this set of "Grand Global Challenges" and providing sage advice to leaders in our organizations as trusted advisors who can develop relevant solutions for advancing quality in organizations and the societies in which they operate to meet these challenges.

Today, there are many myths and misconceptions of the situation and there is also a misuse of technology as solutions that are offered to problems are often unproven and still underdevelopment with no clear application or success case studies that validate their use and demonstrate the cost-benefit situation of their application.

The IAQ will seek to provide an objective, theoretically-sound approach to the incorporation of these advanced technologies that can be pragmatically implemented for the benefit of humanity and the preservation of the biosphere. The current state of this situation as we understand it currently is stated in the following set of principles which define the Grand Challenges that we perceive today.

Principles and Grand Challenges of Quality 4.0:

1. The immediate stimuli of Quality 4.0 is the rapid infusion of digital technologies into applications for productive systems as sensors, algorithms, communications devices, and digitized production and measurement equipment. Packaging these devices as a

service available through the Cloud enables their rapid inclusion and adaptation in current operational processes.

2. Initial digital technologies will tend to do what humans already do but will operate in a faster cycle time and with more reliable performance.

3. Displacement of some human jobs is inevitable in this transformation as it may also be considered inevitable that not all current employees will be able to adapt to value adding jobs in this new digital environment.

4. Competitive advantage is on the side of major firms (e.g., multi-nationals and large national businesses) to rapidly adopt these technologies as this requires sufficient capital access for financial investments as well as developmental power to gain all of the human skills and competence required to effect and enact the transformation.

5. Micro-SME organizations will be the most impacted by this transformation as they do not tend to possess the financial backing or depth in human resources necessary for a full transformation. Their inability to maintain "speed of transformation" with their larger industrial leaders challenges their existence and potential for insourcing of the work that they do.

6. The transformation period of this Quality 4.0 era has an exceptional potential for the shifting of both inter-social class economics and geo-political economics in a way that can create global economic instability and lead to potential conflict.

7. It is imperative to establish the outcome of "quality for humanity" which exits when there is adequate mutual prosperity, sufficient quality of life, and respect for all in a shared community that operates collaboratively rather than competitively.

Plan of Action:

To continue its study of topics that are relevant to this era of Quality 4.0, IAQ has established a Think Tank of Academicians and invited external experts to refine this conversation and establish sound recommendations for application of the related evolving technologies. The purpose of this Think Tank is:

> In the disruptive era of Quality 4.0 this IAQ Think Tank seeks to develop clear understanding of the methodologies, applications, and implications of digital technologies on the methods, tools, and practices of quality as well as its implications for the specialists who engage in this profession and are developing their personal competencies for future application.

IAQ Think Tank Chairman, Dr. Gregory H. Watson commented: "Issues involved in understanding the nature of Quality 4.0 are difficult because the technology itself is challenging and changing while its application must be designed uniquely for every organization." The IAQ Think Tank will develop a set of deliverables to help quality professionals in this transformatin. "What we hope will follow is a broad discussion across the members of the global quality community that will lead to a more open approach to interpreting, communicating, and using digital technologies and discovery of the best practices of their application with an emphasis on the global MSME communities."

About the International Academy of Quality:

IAQ is an independent, self-supported, non-profit, non-governmental organizations that is administered by a collegial assembly of individuals who have been elected by their peers

from among the most respected, active, and experienced protagonists of quality in the world. The purpose of the Academy is to advance quality for the benefit of humanity.

For more information about the Academy, visit the IAQ website at International Academy for Quality (iaquality.org) or email the Quality 4.0 Think Tank leaders: Chairman: Dr. Gregory H. Watson (greg@excellence.fi), Vice-Chairmen: Dr. Pedro Saraiva (pas@eq.uc.pt) and N. "Ram" Ramanathan (ram@100water.org).

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