Research on Quality Management and Sustainability

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ABSTRACT

Purpose - This article aims to ascertain the necessity for specific research on quality management approaches, bringing to the discussion some concerns and challenges to the quality movement, especially in development of new methodologies for supporting design in the digital area.

Design/methodology/approach - Firstly, papers were researched that had already studied the question of what research should carry out in response to the great scientific, technical, and social changes, specifically to support design activities for internet products and secondly we concluded what development is needed.

Findings - The increasing complexity of management and technology creates many situations of anxiety and distress, which often translate into abandonment of proven techniques and methodologies, leading to intuitive approaches. But complexity requires more techniques and methodologies not less. The quality movement faces a serious challenge: how to design in an ethical perspective these types of products.

Research limitations/implications - This research is limited to identify some needs, but future research should be done in characterizing existing answers and identifying what development is needed.

Practical implications - The above findings and reflections can help other researchers to focus on design, to find out practical solutions for sustainability in the innovation process of products and services.

Social implications - Finding out to design in an ethical perspective products and services for internet.

Originality/value - This research identified relevant challenges the quality management is facing, and it gives guidelines for defining research lines.

Keywords: Challenges, Research, Quality, Management, Sustainability**.**

Paper type: Conceptual paper**.**

1. INTRODUTION

The business environment is extremely focused on short term results, which impact negatively any management system in general terms and the quality ones specifically.

Quality management systems are not designed for unstable situations, which are now dominant. Business practices of low investment (ex.: short term, payback of 1 year) doesn´t fit well with planned and systematic actions.

The increasing complexity of management and technology creates many situations of anxiety and despair, which often translate into abandonment of proven techniques and methodologies, leading to intuitive approaches. We often find managers and managers asserting that quality is outdated, embedded in processes, and now it is about productivity, cost effectiveness, and business growth.

In this line of thought, there is also the position that structured approaches complicate, and therefore must be simplified. On the contrary, complexity requires more techniques and methodologies than less.

Thus, it is not difficult to understand the crisis that the quality movement is going through. Many studies in the area show very varied and sometimes contradictory results, so it is important to deepen the research, both to better understand the positive impacts of quality and its shortcomings.

Major technical, scientific, and social changes create new needs. The nature, size, and speed with which these changes must occur bring the need for adaptation of existing techniques and methodologies, but also the urgency of developing new ones.

Finally, social, political, and economic points of view are raising other issues mainly focused on the needs of vast areas of the planet, still as basic as fighting hunger and disease, for example.

Having no future vision, or being limited, we have not looked at these countries as future markets that should be developed, allowing investments to be monetized, but rather as non-existent markets.

The unbalanced development between rich and poor countries and within the rich countries, between regions and social classes, although recognized as long-term pernicious, concerns about the short-term have been crippling to even start moving to the solution.

Whereas the Quality Principles are the Customer focus, Leadership, Engagement of people, Process approach, Improvement, Evidence-based decision making and Relationship management and that the Business Principles are the Business results focus, Flexible/Intuitive, Engagement of qualified people, In instable environment, Innovation, Insight-based decision and Networks and co management, if we compare quality principles with similar ones at the management level, and we can see that there are

worrying discrepancies. This situation is dangerous, and the quality movement needs to rethink approaches and positions at risk of continuing to deteriorate its credibility.

On the other hand, the social impact of media is consensually acknowledged. Some of the most relevant issues can be advanced:

- segment audiences do not contribute to building consensus.
- do not provide useful data and information, they give more disqualified information.
- instead of opening perspectives, they join those who think in the same way.
- presuppose and encourage the elimination of privacy aiming to sale products and services in exchange for access to content. What quality are we dealing with?
- "people have really gotten comfortable not only sharing more information and different kinds, but more openly and with more people. That social norm is just something that has evolved over time." (Mark Zuckerberg, Facebook, 5 years ago).
- Tim Cook from Apple took the opposite stance, while finger-wagging at both Google and Facebook, and said: "We believe that people have a fundamental right to privacy. The American people demand it, the constitution demands it, morality demands it." (https://www.sas.com/pt_br/home.html).

Today the world has almost everything before the eyes, not filtered by scientific knowledge, moral or ethics, but by the tastes of the public (the basis of digital business models). Needs are not identified, but they are created. Companies experiment (in the digital world) and bet where receptivity arises and abandon products/services whenever there isn´t. The emphasis is on the short term (or even immediate) and continuous (and even permanent) development. This reality raises questions relevant to Quality.

However, many misconceptions continue to persist despite major dissemination and quality promotion initiatives: Quality is past (the fashion of quality has already been replaced by others); Quality is embedded in the processes (the quality function in organizations is no longer necessary); Quality is already guaranteed, now we need productivity; Quality is bureaucracy, we need to innovate (an easy way to quick solutions); The most important are soft competences (hard ones, like those of traditional quality, are less or not necessary at all); quality is rules (we don´t need rules, we need a quality culture); we need to do (we don´t need research and development); we don´t need statistic – only analytics - on time data).

Apart from these misconceptions are easy to take apart, some others are more difficult:

1. *Quality assumes intangible aspects, so important that they cannot be defined and therefore evaluated*. Contrary to this position we cannot speak of quality without defining and evaluating it. When we talk about identifying customer needs and expectations, or when we talk about customer satisfaction, we are not just talking about physical measures, but we cannot conclude that it is not possible to measure and objectify; We have to use other techniques and methods that are not typical of Quality Engineering.
2. *Quality is always associated with cost, so that better quality will necessarily have to cost more and / or make the production / service process more difficult*. If in some cases this is the case, in most situations it is possible to improve quality and lower costs simultaneously. The history of quality has been a permanent demonstration of this reality.
3. *Quality is synonymous with technology, so a quality system can only provide a quality product / service if it has the most sophisticated technology*. Technology is a necessary but not enough condition. Even with the most suitable technology, this does not mean that all its potential is being taken away from it. Even getting a top-quality product does not mean it was the first time, using minimal resources. Even if we have used technology properly and achieved the final product at the lowest cost, it does not mean that we can put it in the right time and place and in the conditions desired by customers.
4. *Quality is the qualification of professionals and has nothing to do with management methods and techniques*. This is a matter of frequent misunderstanding. When we talk about quality systems, we are not questioning the qualifications of technicians, but the organizational procedures that ensure that technical activities are not affected by deficiencies in management and support services.

In many cases, the assurance that quality is being achieved at minimum cost is essentially based on the qualifications of professionals.

These misinterpretations, although they result largely from ignorance, deserve reflection and understanding of their causes so that solutions can be devised.

For a better understanding of the appearance of the wrong messages, messenger identification may be relevant. Some of them are:

– Managers (misinformed or poorly trained managers who do not appreciate the planning and structuring of companies. Some of them also do not appreciate procedures that can give them responsibility and discipline).

- Political People (who only appreciate short-term results, who do not understand the technical components, and who are not concerned with public opinion - more sensitive to catastrophic failures than systematic approaches).
- Leaders of professional associations (more concerned with lobbying governments and legislators).
- Leaders of professional quality associations (those who are still in the past with bureaucratic visions and afraid of the future)

2. CHALLENGES OF THE QUALITY MOVEMENT: TECHNOLOGIES, SCIENCE, BIG DATA, AND INNOVATION

2.1. Internet Technologies: Internet of People (IoP), Internet of Things (IoT) and Internet of Emotions (IoE)

According to Porter (2001, p. 63) "some companies have been using internet technology to change the basis of competition away from quality, features and service, making it through price, and thereby making it harder for anyone in their industry to make a profit".

We must not forget the two fundamental factors that determine profitability (universal and above any technology or type of activity):

1. the structure of economic activity (which determines the average profitability of the actors in their respective sectors of activity).
2. the sustainable competitive advantage (which allows to perform above the industry average).

Information and communication technologies have great potential to bring suppliers closer to customers. However, there seems to be a negative tendency to move away. Although online contacts are possible, in many cases they are difficult and in many others are unique (physical presence does not exist), causing dissatisfaction and distrust.

So, we fully agree with Porter when he finds that easy entry into market (or the illusion of easier entry), is destroying the sector competitiveness (Porter, 2001).

Another negative trend has to do with the platforms we call self-service (e.g. check in; banking, public services), where although they bring convenience and advantages to consumers, most of the advantages stay with suppliers (motivations are more focused on saving resources and increasing profits, and less on customer needs).

Transparency is another important issue. The traditional practices of hiding in the "small print" relevant exclusions and ambiguities are now enlarged, sometimes reaching clear swindle.

The Internet of People (IoP) (e.g. e-commerce, ERP, search application) were built to serve people and to accumulate specific types of data that we could analyse later. Internet of Things (IoT) is based on the interconnection of computing devices embedded in everyday objects, enabling them to send and receive data. The IoT enlarges Internet connectivity into physical devices and everyday objects. These devices can communicate and interact with others, and they can be remotely monitored and controlled. The concept of the IoT includes contributions of multiple technologies, such as real-time analytics, machine learning, commodity sensors, and embedded systems. The Table 1 presented de differences by Internet of people and Internet of things.

Table 1 – Internet of People versus Internet of Things

Internet of People (IoP)	Internet of Things (IoT)
- Metal-box type vendors - Set a problem to solve before start collecting data to analyse - Isolated logic - Data will support decision - Traditional analytics applies to processing after the data is stored	- Information vendors - Connect devices, collect data, learn from it and then figure out what to do Connected logic - Data will drive business insights. - Working with event data, when they are happening

Source: adapted from Evan (2011)

The “Industries that stand to gain the most are those that are able to extract the right business insights at the right time and the right place – edge or cloud – based on factors like cost and latency of the underlying business problem.” (Kumar Balasubramanian, General Manager of Internet of Things Solutions at Intel. In https://www.sas.com/pt_br/home.html).

IoT will require partnerships among different types of vendors to keep everything working together. Privacy, security, and legal implications are significant challenges and risks along with unprecedented levels of security and complex infrastructures.

We know that many decisions are not rational, but emotional. We know many non-rational decisions, including mental buying mechanisms. The internet has a huge offer of information, shopping, entertainment, and interaction services.

The design of many of these new products assumes at the outset that they must be shocking and impressive, or to put it another way, they must trigger successive emotional states that lead to using, buying, playing, or interacting more, keeping the user eager to continue. The products are designed

to have incentives to multiply the emotion of each instalment (news, television news, reporting ...) (Fukuda, 2011).

In addition to psychological and social problems, such as the loss of emotional learning ability (interactions are mostly via the internet), and easy access to information without intermediation (technology is used to create emotions and fabular), quality movement faces a serious challenge: how to design in an ethical perspective these type of products and which techniques and methodologies are available do support design activities and what development is needed (Dennis & Kappas, 2014).

To answer some questions, some contributions were attempted like the adaption of QFD (more in the name than in substance - Emotional Engineering, Affective Engineering) (Nagamachi, 2010).

Kansei methodology is coming from other point of view the user- centred design (Neto and Pires, 2019).

From the artificial intelligence side arises the term "HumanRithms" (Human Algorithms), transferring knowledge from neurosciences to computer sciences (Candamo et al, 2010).

Benski & Fisher (2014) state. "Most notably, research into online worlds (particularly games) finds that they provide immersive experiences which invoke a high level of emotional engagement and a strong sense of presence and intimacy" (Preface).

Küster & Kappas (2014) suggest 3 phases for researching: first, researchers can study large amounts of emotional content on the Internet. Second, they can ask individuals about their emotional experience online. Third, they can record bodily responses to measure emotions unobtrusively.

2.2. Technology Based Quality or Science Based Quality

Today, technology has always a scientific base (it was not true in the past). This is a good starting point for revisiting quality techniques and methodologies to strengthen and develop its scientific base. Some approaches have been developed based on the experience of quality professionals who have sacrificed scientific foundations over pragmatism. Acknowledging that the vast majority turns out to be useful, but their results show too much variability, depending on many variables (e.g. activity sector, dimension, culture, human development, economic development).

Particularly interesting is the observation of how to speak and write about topics on which education is poor (human resources, motivation, leadership, strategy, expectations, satisfaction, culture), as is the case of quality professionals.

Quality turns out to be a set of engineering techniques and methods framed by management concepts, which results in a mix that is very eclectic.

Technical and scientific developments, the average rise in purchasing power and education, and increased competition have led to a growing momentum in introducing new products and services, or significantly changed existing products.

In this way, innovation gained greater prominence even emerging as an alternative to quality. However, careful analysis of the product life cycle and particularly from its idealization allows us to conclude that quality stems from the organization's interface with the market, identifying the needs and expectations of market segments and their transposition to product and service requirements, ie innovation at this level.

Unfortunately, innovation is not a panacea for quick and easy solutions, but a complex process with many variables and interactions between areas of knowledge, technologies and functional areas of organizations. This process requires increasingly complex techniques and methodologies because failures at these stages of the life cycle have potentially devastating consequences.

The design process implies the progressive reduction of uncertainty, which can only be achieved with higher levels of knowledge (scientific and/or organizational). In other words, innovation implies risk, as the greater the degree of novelty, but also resources (human and financial).

Additionally, the entrepreneurship environments should be adequate.

In an innovative environment there is less interest on what we know and more interest on what we don´t know.

If we talk about Quality Management Systems (QMS) based on a procedure environment is difficult to innovate, which may justify the scepticism of many managers and researchers.

However, concerning science, some paradoxes arise that should not be expected to resolve. We must manage them in the best way.

Science is not democratic (it is not accessible and useful for all; few control their development). But science is essential for a democratic society (enabling broad access to information, technology and supporting many of the institutions of democracy in their functioning and in relations with citizens).

The public funds (R&D) will stop at the private companies (EUA, 2018). Public universities (and faculty) are evaluated by private rankings. States don´t provide services but should satisfy population needs.

The scientific community has never been so large and so influential, but the limits of science follow a centrifugal movement without sufficient synthesis efforts, which makes easy advances difficult

(what is something new) as stated Araújo (2018): "No one can create new knowledge if it does not spend more than ten thousand hours on a subject." 1250 days and 3, 42 years. Who pays for it?

2.3. Big Data or Big Knowledge

We all know, feel, and live the increasing digitization amending labour relations, business organization, machines, and processes.

From the point of view of knowledge management and organizational learning, a practical scheme can help to understand and monitor (Figure 1).

Figure 1 - knowledge management and organizational learning

Data is not information, but can translated into information, through adequate treatment and interpretation, like tables, figures, models, equations.

Information is not knowledge. This comes from science or from experience and testing inside organizations allowing specific knowledge only available internally. If this specific knowledge can be generalized, we can talk about wisdom.

The availability of large amounts of data has aroused interest in their processing and has fostered the development of statistical techniques and methods, with the aim of obtaining information that supports decisions but also obtaining higher levels of knowledge (analytics - analytical intelligence).

Some authors call for cognitive capitalism (e.g. Rindermann, 2012) and Simbolic capitalism (e.g. Fuller & Tian, 2006).

Analytical Intelligence is a comprehensive, multidimensional field that uses mathematical, statistical, predictive modelling, and machine learning techniques to find meaningful patterns and knowledge in data.

With faster and more powerful computers, the opportunity for analytics and big data is plentiful. Examples and are:

- companies can find new ways to mitigate risk and increase profit.
- data scientists can explore their logical reasoning.
- business can improve predictive analytics.
- business can get insights at the right time and the right place – edge or cloud – based on factors like cost and latency of the underlying business problem.

The Table 2 presented a comparison between the Statistics and the Analytics.

Table 2 - Statistics Versus Analytics

Statistics	Analytics
Tendencies	On time values
Variation	So reduced, we don´t need to care
Capacity	We always can achieve
Correlations	Patterns, Fractals
Design of Experiments	Some variables at each time?
Metrology	Technology (auto calibration)
Hard Skills	Soft Skills
Quality of products	Control the decision process
Process control	Mental schemes of the decision-making process
Experientation	Emotional decisions (70% !?)
Testing	Emotional quality ? (Kansei, QFD…)

This comparison shows the basic statistics knowledge is the primary skill needed, but other issues are also relevant to deal with.

Other related issue is the concept of event stream processing. This is the process of quickly analysing time-based data as it is being created and before it is stored, even at the instant that it is streaming from one device to another - influencing a situation before it is over.

Whereas:

1. Event – An event is any occurrence that happens at a clearly defined time and is recorded in a collection of fields.
2. Stream – A data stream is a constant flow of data events, or a steady rush of data that flows into and around your business from thousands of connected devices and other sensored “things.”
3. Processing – The act of analysing data.

Event stream processing can be viewed from three point of view (Tomasz, 2013):

- **At-the-edge analytics** (processed on the same device from which it is streaming) (Ex: thermostat, your iPhone or any single sensor with processing capabilities) - This type of analytics works with minimal context to the data, often confined to rudimentary rules and simple statistics like average or standard deviation.
- **In-stream analytics** (occur as data streams from one device to another, or from multiple sensors to an aggregation point) (Ex: analysing mobile phone use) - This type of analysis combines events of different types and alternate formats that are transmitting at varied rates.

- **At-rest analytics** (occurs when there is a historical repository of data). It is based on rich, historical context – the perspective required to create predictive analytical models and forecasts and to discover new patterns of interest.

Regarding this, term edge is also applied to devices. An edge device is any piece of hardware that controls data flow at the boundary between two networks. For instance, cloud computing and the internet of things (IoT) have enhanced the role of edge devices, fostering the need for more intelligence, computing power and advanced services at the network edge. The Table 3 presented the event processing.

Table 3 – Event processing

Event stream processing	
Traditional analytics • Receive and store data. • Prepare data. • Process/analise data. • Get results and share as needed.	**Event stream processing** • Store queries/analysis. • Receive data. • Process data. • Push results immediately (often to trigger a reaction).
It can occur in three distinct phases: - at the edge of the network - in the stream, - on data that's at rest, out of the stream	

Source: Bolen (2011)

Networks are starting to connect all sorts of things together and collect the data. With insights from this IoT data, many businesses are already boosting productivity and driving greater operational efficiencies (Ex: Predictive machine maintenance and performance optimization; Precision agriculture).

Streaming data from the IoT helps organizations understand their businesses better because it allows constant monitoring. The result is often a more customer-centric business model, allowing data to drive business insights. However, some disturbances and bad attitudes must be taken care of: withdrawal from customers and using the data in a partial and amateur way and in view of the complexity of the interpretation, only use intuition again - based on data intuition!

2.4. Product/Quality/ Innovation Cycle: Design for Emotions

Starting from the functional approach (the levels of satisfaction and importance of functions define quality) and its relationship with the costs that customers are willing to pay, we can now look at new digital products. Value is the relationship between quality and cost.

The internet (or the excess of technology) leads to massification (positive side), and to go through everything fast (trivial and profound) and obviously staying longer in what is easier to learn in an intuitive (or manipulated) way. Culture and traditional information are under pressure and seems to have difficulty for responding.

Here, too, the question of quality arises. Mass audiences want what the traditional media cannot provide. Are they failing to identify needs? Or are they unable to segment markets and consumers to offer each other dedicated products? Is it because of some kind of intellectual arrogance of the elites? (Chatfield, 2012).

Artificial intelligence can help to identify or create potential functions (see The Figure 2)

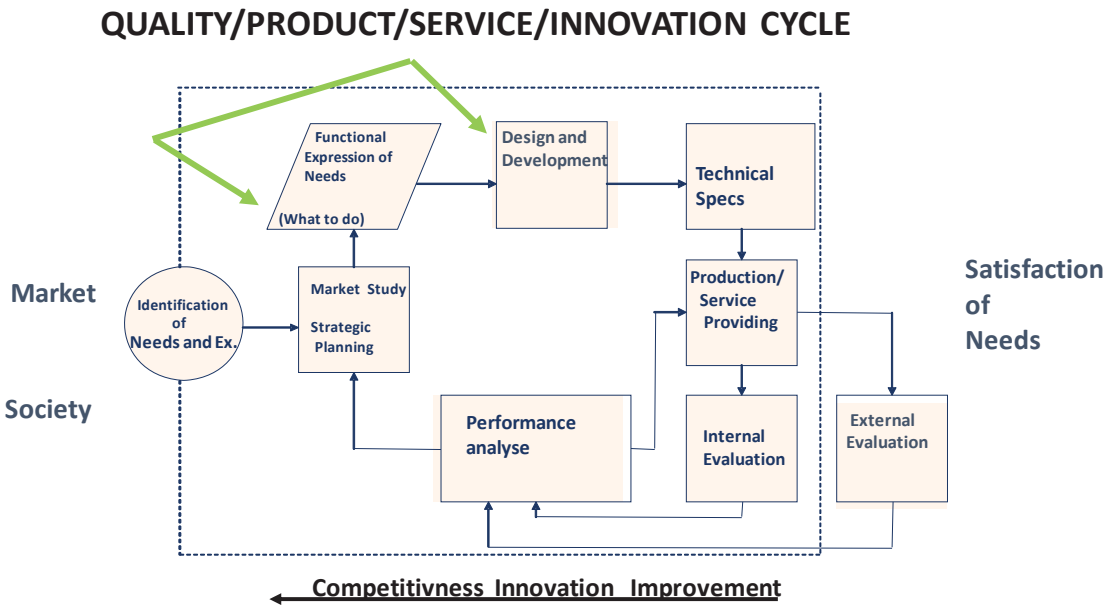

Figure 2 - Product/Quality/ Innovation Cycle

Source: Pires (2016)

As noted in the Figure 2, the critical activities for competitiveness lie in the early stages of the innovation cycle, where they are identified (or created) the needs and expectations and where they are translated into requirements for products and services.

The cyclical character of innovation is represented by the direction of the arrows. This cycle is to be run more often and faster, sometimes leading to dramatic changes in products, processes, technologies, marketing solutions and in the structural formats of organizations themselves.

Therefore, the question arises: How to design products for emotions ethically, since personal people's personal lives are being used without permission. How to design getting on time feedback and continuously improvement? we need to change paradigms and create new tools, co-creation,

customer-centred design, emotional engineering can give some insights, but sure that we need multidisciplinary teams.

The early stages of the life cycle and particularly design is becoming increasingly important because the best sustainability solutions can be found here, considering all impacts on the life cycle. Reverse logistics complements the efforts made in design.

Lastly, we fully agree with Klöpffer (2002:133): "It is the duty of researchers and experts of different fields to develop and improve methods that can be used to operationalize the guiding principle of sustainability". The technical solutions must necessarily have scientific support, essential condition to minimize risks throughout the life cycle.

We can easily agree that the rise of digital is having huge impacts on business models and cultural perspectives. For instance, the time spent in digital environments (games ...) seems to be emotionally rewarding (perhaps even to "forget" real life). These are other needs that designers must consider: creating products for the real world and products for the virtual world.

However, there is a big misunderstanding: The power to create cultural and intellectual works is concentrated on those who control the infrastructure (where the works are disseminated). Instead of "democratization", we are witnessing concentration in the hands of very few. Moreover, these are not exactly talents in art, culture, politics…. And science! although the creation of niches is possible, the most relevant is the growth of an increasingly influential small group (Chatfield, 2012).

Can we talk about Post Neo Quality? Meaning that quality movement needs to update the scientific base of its approaches in the light of implementation experience and case studies research to generalizability and transferability. So, it is essential: analyse initial theory/approach; enhance this with new information in the form of theoretical contributions from multidiscipline; synthesize prior and new information to produce an updated theory (Dixon-Woods et al., 2011).

3. CHALLENGES FOR R&D AND FUTURE OF QUALITY MOVEMENT

3.1. Challenges for R&D

The following topics illustrate points of consensus and disagreement

- Client satisfaction. Customer satisfaction remains a key theme. However, the satisfaction construct has evolved to include positive experiences, expectations management and emotional relationships. ICTs are changing supplier-customer relationships, not always in the positive sense.

- Shareholders (more than direct client) is a practically not researched field, but with a great potential, since a networked society is being built.
- Society. The last goal of all economic activity spreads far beyond the quality of products and services, assuming political and philosophical dimensions.
- Impact of quality practices in performance and success. Quality practices should contribute to performance (at various levels), either individually or in some form of joint application. These themes have been investigated, generally with positive results, but also with negative results. Saraiva et al (2018) performed a critical analysis of the literature reviews, concluding that there were contradictory, controversial, or even conflicting results, suggesting that more variables should be included (e.g. sector of activity, company size, certification dimension, human development, scientific affiliation of researchers, economic development).
- Rhetoric of quality. For a long time, we have characterized the situation as the rhetoric of quality, meaning that the apologetic statements do not always correspond to reality (Pires, 2016).
- New tools (to deal with design for emotions respecting ethical principles and a bearing in mind a perspective of social responsibility).

Research on organizational design falls largely within the sphere of organizational theories, where quality has made little contribution. However, the drastic and rapid changes in products, services and processes raise the question of whether organizations' traditional structural formats can cope with increasing complexity. The traditional two dimensions of organizational charts are not enough to represent the multidimensional characteristics of today and emergent structural formats as networks, company chains and joint ventures. Without constituting a finished solution, the concept of multidimensional organization is landmark (Ackoff, 1999).

Much has been written about the importance of knowledge and its management. The popular expression of the knowledge economy is a recognition that science will play a more relevant role, without forgetting the knowledge acquired by organizations.

In a quick and simple perspective, we leave a summary reflection on possible approaches, which can range from countries that own, produce and maintain leadership in knowledge (north countries), even those that bet more on their valorisation (orient, global south).

Another point of view has to do with the language. Although English continues to be the dominant language, other languages emerge, reflecting the respective areas of influence:

Ibero american	**Africa**	**Asia**	**USA, Canada, UK**	**Global**
Portuguese	Portuguese	Chinese	English	North
Spanish	Spanish	Japanese		South
	English	Korean		
	French			
	Native			

Some R&D results show controversial, conflicting, and even contradictory and /or non-consensual outcomes in different countries, which could suggest that dimensions are lacking. Specifically, an attempt was made to identify other issues that may explain the divergences, such as methodological issues, scientific affiliation of researchers, insufficient details in the design of the investigation, and in the collection and analysis of data, and in this way to outline guidelines for areas lacking theoretical deepening (Saraiva et al, 2018). So, we have concluded that more applied research is needed to support the quality movement. Competitiveness moves rapidly from the areas of production/service delivery to those closest to the market, such as identifying needs and transposing them into products and services. Thus, quality must focus more on these areas, refining existing techniques and methodologies and creating new ones. Unfortunately, innovation is not a panacea for quick and easy solutions, but a complex process with many variables and interactions between areas of knowledge, technologies, and functional areas of organizations. In particular, the need to explore the interactions and interrelationships between quality practices is emphasized.

The quality movement needs to foster longitudinal studies, looking for universal laws, what can be done through multidisciplinary only.

3.2 Future of Quality Movement

The following topics illustrate some challenging issues to deal with by quality movement

- Focus on attractive quality: We usually think of ‘attractive’ in the same sentence as physical appearance. But deep down, what we really find most attractive is value, satisfaction, unexpected, surprising.
- Competition leads to similar products and services, which necessarily leads to major differentiation efforts.
- Emotions must be considered whether they arise from living needs or whether they are established in personal connections to products and services and their suppliers
- In this way, expressions such acceptable for attraction can included in the functional expression of needs.

- Emergence of new forms of citizen participation in service design, delivery, and evaluation processes. Examples are:
  - Systems interoperability.
  - Possibilities for greater individualization of services (at lower cost).
  - New service design approaches.
  - Co-production and co-creation (a user view as co-producer - and value in use).
- More research on interactions. Many studies have not considered possible interaction between quality practices (e.g. Nair, 2005; Dahlgaard-Park et al, 2012; Sousa & Voss, 2002). In fact, nowadays we should be more focused on interactions than actions, because most knowledge is based on actions and few attempts are done on interactions. Nair (2005) states there is evidence of complex cross relations among QM practices. This is one typical example of the mess (situations characterized by complex systems, where there are highly interactive problems) where researcher on quality issues was down.

In this regard, it is pertinent to quote Dahlgaard-Park et al (2012, pp. 421):

1. "Hence the challenges have been continuously: to adjust and modify the QM framework and at the same time to continuously develop better tools and techniques in order to fit with the needs of these new service and knowledge intensified organizations".
2. "One of the critical challenges in the future can be for instance: to develop better tools and techniques which can be adopted for realization of value co-creation between customers and service providers in service contexts. Accordingly developing a way to better involve and empower customers in all processes will be a critical issue".

According to Sousa & Voss (2002):

- Interaction effects and interrelationship might also exist among QM practices and between the various performance dimensions.
- These interaction effects: distinguish successful companies from others and being a promising avenue for future research.

Finally, this set of issues arise the question of the future of quality professionals. The issue of the future competences of quality professionals has been discussed and the perspective points out the extension of data processing (Analytical Intelligence). However, the scope of application remains essentially the same (monitoring of processes), leaving a large area uncovered, exactly those that are most critical (interface with market, design for emotions).

The traditional areas of support for quality control and management (Industrial Engineering and Management) are struggling to maintain leadership, with the main contributions being made by the computer sciences and marketing.

As an example of the difficulty in finding a solution, various names are given for new competencies and roles within organizations:

- Blogger-in-Chief
- Director of Emerging Technologies for Best Practices
- Insights Editor
- Principal Data Scientist (some are mathematicians, part computer scientists and part trend watchers)
- Chief analytics officer
- Data manager
- Insights accelerator
- improvement specialists

About the Future of Quality Associations, as the business world and societies are in deep transformation, the associative structures of quality professionals are in serious difficulty finding their way to social utility.

There are no known studies or investigations that have focused on services, technical and scientific skills. However, the accumulated knowledge shows that many are reduced to bureaucratic structures, and it is urgent to rethink the mission and redefine strategies that can respond to the needs of the people and companies of our time.

For example, it would be expected that the European Organization for Quality (EOQ) would intervene at the level of the European community and the European area, through projects, and close and intervening relationships with policy makers and regulators. In an information and knowledge society, EOQ should be the holder of qualified information and knowledge, developing collaborative networks with its members and with the technical and scientific community of Europe and the world. Instead, it has a marginal role and has no communication tool (e.g. a specialist magazine), no knowledge (e.g. book publishing), no studies and reflections about the future.

However, the potential exists, such as the network that its members constitute and the synergies that can be exploited. The confounding weaknesses can be turned into strengths by focusing on knowledge production and dissemination, using the potential of information and communication technologies.

EOQ Network! What for? EOQ and EOQ Members. Are they connected? Have they data scientists? What about analytics? What about quality practices? Which relationships with academia and research? Why not a Collaborative European Journal? (Technical or/and Scientific?)

These are some of the issues that urgently need an answer for Quality Associations to survive, so a paradigm shift is needed to meet the digital society.

4. FINAL COMMENTS

There seems to be no single, structured way to create theories, but neither do there seem to be many researchers interested in the task. In multidisciplinary areas, the difficulties increase, as only research groups can be successful. In any case, without pressure for theoretical development, quality management will fall into a secondary position and will be reduced to limited empirical studies.

However, it must be admitted that there are some paradoxical aspects. The objective of creating a comprehensive theory (using contributions from various areas of knowledge), while constituting a generous purpose, easily falls into the impossibility of considering all variables, being easily criticized, since some of them were not considered.

In terms of operationalizing the variables, it can also be concluded that the multidimensional approach to QM practices and the performance of organizations is a better choice than just one dimension. As for the effects of interactions and interrelationships between QM practices and between these and the various performance dimensions, it is also known that they exist, but less is known about the mechanisms through which they manifest themselves.

However, if the identified challenges for the quality movement reach positive answers, those contributions will be relevant for sustainability of organizations, allowing them to be successful in the actual business context in such a way that they will successful in the future also.

The most critical activities for competitiveness lie in the early stages of the innovation cycle, where they are identified (or created) the needs and expectations and where they are translated into requirements for products and services. These early stages and particularly design is becoming increasingly important because the best sustainability solutions can be found here, considering all impacts on the life cycle. Reverse logistics complements the efforts made in design. The technical solutions must necessarily have scientific support, essential condition to minimize risks throughout the life cycle.

Lastly, this paper agrees with Klöpffer (2002:133), quality researchers and experts of different fields must develop and improve methods to operationalize the guiding principle of sustainability.

Nevertheless, the rise of digital is having huge impacts on business models and cultural perspectives and consequently on design and sustainability.

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Comparing quality profiles in Human-Robot Collaboration: empirical evidence in the automotive sector

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STRUCTURED ABSTRACT

Purpose- Human-Robot Collaboration (HRC) is a paradigm that is gradually consolidating in the industrial field. The goal of this paradigm is to combine human and robot skills to make production more flexible. An effective implementation of HRC requires a careful analysis of its different aspects, related to both robots and humans. For this reason, the development of a tool able to consider all HRC aspects to evaluate the collaboration quality is a real practical need.

Design/methodology/approach- In a previous work, Gervasi et al. (2020) proposed a multidimensional framework to evaluate HRC quality. This framework has been tested on a real industrial HRC application in the automotive sector. Two different alternatives of the same assembly task were analyzed and compared on the quality reference framework.

Findings- The comparison between the two alternatives of the same assembly task highlighted the framework's ability to detect the effects of different configurations on the various HRC dimensions. This ability can be useful in decision making processes and in improving the collaboration quality.

Social implications- The framework considers the human aspects related to the interaction with robots, allowing to effectively monitor and improve the collaboration quality and operator satisfaction.

Originality/value- This paper extends and shows the use of the HRC evaluation framework proposed by Gervasi et al. (2020) on real industrial applications. In addition, an HRC application implemented in an important automotive company is described and analyzed in detail.

Keywords: Human-Robot Collaboration, HRC evaluation framework, Automotive industry.

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