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THEORY OF QUALITY MANAGEMENT: ITS ORIGINS AND HISTORY

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ABSTRACT

Purpose: Determination of the theoretical and philosophical foundations of quality management, as they have evolved and changed over time.

Methodology/Approach: Conceptual and historical.

Findings: At the origin of the quality movement, Shewhart defined quality through an account of production (later called value generation theory), and suggested the scientific model (later to be named as Plan-Do-Check-Act cycle, PDCA) as the epistemology for improving quality. Somewhat later, Deming recommended ideas falling into process ontology as applicable in the quality context. These prescriptions were not presented in terms of theory, epistemology or ontology but through examples. Perhaps partly for that reason, in subsequent developments these prescriptions were often forgotten or rejected. Especially, the ISO standard for quality management rediscovered the original PDCA epistemology only in 2015. Thus, the degeneration of the original theoretical and philosophical foundation seems to be one of the longstanding problems in the area of quality.

On the other hand, it has turned out that the value generation theory of production is a partial theory. As the success of the lean movement indicates, production should also be seen through the flow theory. The achievement of quality can, for its part, also be explained through this flow theory of production. However, there has been very little theoretical work both regarding production and quality, and thus the integration of theories on production has not been achieved. Lacking theoretical evolution is another long-standing problem that arguably has hindered the progress of quality.

Research implication: The findings call for a sustained effort to explicate and develop the theoretical and philosophical foundation of quality management.
Originality/Value of paper: It is widely perceived that quality as a managerial focus has lost its attraction in the last two decades. In this presentation, the argument that weaknesses of the theoretical and philosophical foundation of quality have contributed to this lack of attraction is forwarded.

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KEYWORDS

Quality management, production, theory, ontology, epistemology.

INTRODUCTION

There is an influential school of thought in management studies contending that all or at least most managerial methods are fashions or fads, having their lifecycle similarly to living organisms. From this perspective, quality seems to have passed its heyday, as indicated by the frequency with which quality related terms are being used in published books (Figure 1). Indeed, the decline of the quality movement is visible in many ways. It is stated that "during the first 10 years of the new millennium, the term TQM seems to have lost its attractiveness in Western parts of the world" (Dahlgaard-Park 2011). The ISO 9000 quality standards are bitterly criticized (Seddon 1997, Hoyle 2007), and the benefits to be derived from their implementation are debated. Hoyle (2007) writes:

> "…resultant confusion [around ISO 9000]. The standard could have been written better but it is unfair to put all the blame on the standard. The standards bodies, certification bodies, accreditation bodies, training providers, consultants, software providers and many others have contributed to this confusion. Commercial interests have as usual compromised quality. We have followed like sheep, pursued goals without challenging whether they were the right goals but most of all we have forgotten why we were doing this. It was to improve quality, but clearly it has not."

What are the causes of this apparent decline? We posit that the usual ways of looking at the history of quality are not helpful for perceiving such causes. Namely, typically such history is structured according to the contributions of gurus of quality (Zairi 2013) or according to different approaches to quality (Juran 1995). Such foci are not helpful for understanding the underlying theoretical and philosophical assumptions of quality or for examining whether they are adequate.

In this presentation, the argument that weaknesses of the theoretical and philosophical foundation of quality have contributed to this lack of attraction is forwarded. The paper aims at the determination of the theoretical and philosophical foundations of quality, as they have evolved and changed over time, and at explanation of the decline of the quality discipline through those foundations.

Figure 1. The frequency of the word strings "quality control", "TQM" and "ISO 9000" in books published in English in 1930 – 2008, according to Ngram.

THEORY OF QUALITY MANAGEMENT: THE ORIGINS

Scott and Cole (2000) claim that the quality effort is not readily linked to a well-identified, clearly specified set of ideas and practices but, rather, appears as a loosely coupled collection of orientations and practices. We disagree with this judgement. The seminal authors on quality have presented influential theoretical and philosophical starting points for quality. Unfortunately, those starting points fall outside the usual paradigms of management scholars, and they have failed to spot them.

It is thus deserved to ask from where the theoretical and philosophical ideas of quality management can be found. We contend that there are three promising places:

- First, quality is usually, although not always, related to man-made artefacts that have been designed and produced. Thus, it seems natural to expect that the concept of quality is related to or embedded in concepts and theories of production.
- Second, for maintaining and improving quality, information and knowledge are needed. From where should that be acquired? The discipline studying such matters has traditionally been called epistemology. So, it can be expected that that the concept of quality would entail epistemological considerations.
- Third, for perceiving and acting for the sake of quality, a conception on what is out there in the world is needed. The discipline studying such matters is ontology. It can be expected that the concept of quality would entail ontological considerations.

In the following, the three identified topics are explored.

THEORY OF PRODUCTION

It is well-known that Shewhart started the quality movement through his statistical quality control. In his seminal book (Shewhart 1931), he related quality to design and production in the following way:

> Looked at broadly there are at a given time certain human wants to be fulfilled through the fabrication of raw materials into finished products of different kind. […]
>
> The first step of the engineer in trying to satisfy these wants is therefore that of translating as nearly as possible these wants into the physical characteristics of the thing manufactured to satisfy these wants. In taking this step intuition and judgement play an important role as well as the broad knowledge of the human element involved in the wants of individuals.
>
> The second step of the engineer is to set up ways and means of obtaining a product which will differ from the arbitrarily set standards for these quality characteristics by no more than may be left to chance.

The conceptualization of production used by Shewhart has later been named value generation model (Koskela 2000). In contrast to two earlier conceptualizations of production, the transformation model and the flow model (Koskela 2000), the value generation model introduces the customer into theorizing on production.

EPISTEMOLOGY

On which knowledge basis envisaged Shewhart "setting up ways and means" to achieve quality to happen? Arguably, the existing scientific and engineering knowledge related to any particular production process has to be used. However, the novelty advanced by Shewhart was that additionally, the scientific method (Shewhart and Deming 1939) is to be used:

> In this sense, specification, production, and inspection correspond respectively to making a hypothesis, carrying out an experiment, and testing the hypothesis. These three steps constitute a dynamic scientific process of acquiring knowledge.

This idea contrasts with the attitude in engineering sciences according to which engineering proceeds from scientific knowledge towards application. This contrast has time-honoured roots – it has been characterized as the difference between Platonic and Aristotelian epistemology (Koskela & al. 2018). In the context of engineering, Platonic epistemology starts from reason (and in extended sense, from existing knowledge) and deduces prescriptions to be pushed towards the world. Instead, Aristotelian epistemology emphasizes observations made on the world and induction of new knowledge based on them.

ONTOLOGY

Deming, a close collaborator of Shewhart, presented his ontological views in his book "Out of the crisis" (Deming 1982):

> Every activity, every job is part of the process. A flow diagram of any process will divide the work into stages. The stages as a whole form the process. The stages are not individual entities…

Further (Deming 1982):

> Work comes into any stage, changes state, and moves on into the next stage. Any stage has a customer, the next stage. The final stage will send product or service to the ultimate customer, he that buys the product or the service. At every stage there will be:
>
> Production – change of state, input changes to output. Something happens to material or papers that come into any stage. They go out in a different state.
>
> Continual improvement of methods and procedures, aimed at better satisfaction of the customer (user) at the next stage.
>
> Each stage works with the next stage and with the preceding stage toward optimum accommodation, all stages working together toward quality that the ultimate customer will boast about.

This represents process metaphysics (Rescher 2000), characterized by its focus on temporal developments, and relations between phenomena. It starkly contrasts to the more well-known thing metaphysics, which directs attention to (relatively) stable things and their composition (Koskela & Kagioglou 2005, 2006).

SUBSEQUENT DEVELOPMENTS IN THE MAINSTREAM UNDERSTANDING OF QUALITY MANAGEMENT

How have the discussed theoretical, epistemological and ontological starting points influenced the evolution of quality ideas?

Shewhart embedded the notion of quality into a conceptualization of production as value generation to the customer. This became almost a mantra in the subsequent quality movement. It is clearly visible in the suggestion of Juran (1999) to distinguish between quality as q, freedom from defects, and quality as Q, overall satisfaction of the customer. Also, the ISO 9000 quality standard strongly emphasizes these matters. The quality methodologies have developed in correspondence with the evolution of the concept of quality. The focus has changed from an inspection orientation (sampling theory), through process control (statistical process control and the seven tools), to continuous process improvement (the new seven tools), and to designing quality into the product and process (Quality Function Deployment).

As a production paradigm, the quality movement originated in Japan. Quality issues were attended to by the Japanese industry under the guidance of Deming, Juran and Feigenbaum. The quality movement in Japan soon evolved from mere inspection of products to total quality control (or Total Quality Management). Here, the term total refers to three extensions (Shingo 1988): (1) expanding quality control from production to all departments, (2) expanding quality control from workers to management, and (3) expanding the notion of quality to cover all operations in the company.

This Total Quality Management approach that originated in Japan was aligned to the epistemology proposed by Shewhart. The key indication for this is the position given to the scientific experimentation, in the form of the Plan-Do-Check-Act cycle. Thus, for example, Spear and Bowen (1999) described the epistemology of the Toyota Production System with almost the same wording as Shewhart: "whenever Toyota defines a specification, it is establishing sets of hypotheses that can be tested. Thus, the scientific method is followed." However, Spear and Bowen seem not to have been aware of the prior work by Shewhart and Deming – they do not cite them.

More generally, Dean and Bowen (1994) contended that in Total Quality Management, there are three basic principles and respective practices and techniques. These principles are: (1) customer focus, (2) continuous improvement, and (3) teamwork. These neatly correspond to the underlying theory of quality as discussed above:

- Customer focus is compatible with the value generation model of production.
- Continuous improvement is compatible both with Aristotelian epistemology and process metaphysics.
- Teamwork is compatible with process metaphysics.

Thus, the theoretical and philosophical starting points as defined by the seminal thinkers on quality have clearly been influential in the subsequent evolution of the quality movement, at least when it comes to the shaping of Total Quality Management. However, in closer examination, two problematic tendencies become visible: (1) independently from the quality movement, quality practices and techniques have been developed based on another theory of production, (improvement outside the starting

points) and (2) the original starting points are forgotten or misunderstood (deterioration).

QUALITY BASED ON THE FLOW THEORY OF PRODUCTION

In parallel to the early development of the mainstream quality ideas, quality started to be developed from different starting points. Here, an account from the Web site of Toyota is illustrative (Toyota 2004):

> When Taiichi Ohno became manager of Final Assembly in the Manufacturing Department of Toyota Motor Corporation in 1945, he faced a huge challenge. Toyota had become highly inefficient during the Second World War, and Kiichiro Toyoda's Just-in-Time system had collapsed completely.
>
> Just-in-Time dictates that parts are delivered to the right part of the assembly line, at the right time and in the right amount. However, for this to work effectively, Ohno realized that another factor had to be controlled: quality. Parts must be flawless and defects must be eliminated before progressing along the line. This is when jidoka, the second pillar of what would later become the Toyota Production System, entered the picture.

This overall account of the developments can be corroborated through other sources (Ohno 1988, Shingo 1986). There are two aspects calling for attention. First, quality is embedded in the flow conceptualization of production (Koskela 2000): quality was needed – not primarily for the sake of the customer, but for realizing the Just-in-Time system that is designed based on prescriptions derived from seeing production as flow. The reduction of temporal variability is a key principle according to the flow model. This contrasts to the reduction of variation related to dimensional and functional attributes of parts, as implied by the doctrine of the value generation model.

Second, an examination of the concept of *jidoka* reveals that quality was approached from inside production, and generic tools, such as source inspection and fool-proofing mechanisms, *poka yoke*, were promoted for ensuring zero defects in produced parts (Shingo 1988). This contrasts to the mainstream quality thinking that looks at quality as an outcome of production, and assumes the rectification of a quality problem to be one of a kind, separate from general improvement of production.

All in all, this seemingly led to a more aggressive and effective elimination of defects than in the case of mainstream quality movement. Tellingly, Hino (2005) writes about quality at Toyota:

> The requirements of ISO 9000/QS 9000 were more than satisfied by practices and systems Toyota had established through its TQC/TQM activities, including policy deployment, management by functions, top management diagnoses, process control, design review, document control, quality audits, and quality education and training. ISO 9000/QS 9000 was unnecessary for Toyota, moreover, because it was incomplete: It did not deal with cost, one of the two pillars of management.

This superiority of a quality concept based primarily on the flow model of production suggests that anchoring quality to the value generation model is too narrow and restrictive starting point.

EPISTEMOLOGY

After the heyday of total quality management, the wider implementation of quality ideas in the industry has been supported by the ISO 9000 series of quality standards,

first published in 1987 and revised in 1994. These standards contained a prescriptive approach to quality: they stipulated which kind of documents should be prepared for the quality system. This represents Platonic epistemology (Koskela et al. 2018): existing knowledge is pushed to the world. The Aristotelian element was more or less absent. Cogently, a book guiding on the implementation of the ISO standard contained just this one line on PDCA, nothing more (Badiru 1995): "Deming's PDCA cycle, for example, is a simple model to implement".

A new version of the ISO standard was published in 2000; it contained prescriptions on continual improvement of the quality management system (Hoyle 2001). Unfortunately, the wording gave the (probably unintended) impression that the object of continual improvement is the quality management system rather than the organization and its productive activities. All in all, continuous improvement based on the PDCA cycle was sidelined in quality efforts based on the ISO standard. A telling example is provided by a recent PhD work, where the author could not find even one case where identified quality problems would have led to improvement action in the studied organizations that followed the mentioned standard (Taggart 2016).

It is only the newest version of the standard (ISO 9001:2015) that takes a much less procedural approach and stresses the application of the PDCA cycle at all levels of an organization. Ironically, a seminal idea, presented more than 80 years earlier, was thus finally rediscovered by the quality movement.

Generally, the reception of this epistemological foundation of quality has been strangely mixed. On one hand, there are attempts to define a science of improvement based on the PDCA cycle (Langley et al. 2009). On the other hand, a recent popular management book (Syed 2015) discusses learning from mistakes without any reference to the corresponding established ideas and techniques, like PDCA, used in quality efforts. While these ideas attract enthusiastic followers who deepen and operationalize them, at the same time they seem to be unknown to many.

ONTOLOGY

The practical import of the metaphysical (or ontological) starting points for quality management is in the emphasis on relationships between different things and processes, and on continuous change, especially continuous improvement (irrespective of the source of improvement).

Not all developments in the quality methodology have subscribed to these emphases. Business process design (or re-engineerig) emerged as a popular tool for quality. In Harrington's (1991) influential book on business process design, only 2 % of the pages (5 and a half pages out of 274) are addressing continuous improvement. It may be that this inability to embrace continuous improvement has cultural reasons (de Oliveira & Nisbett 2017): in Western thinking, there is an expectation of lack of change, whereas East-Asian thinking assumes states of the world to be subject to constant change as interconnected parts engage in dynamic, mutual influence. The observations of the Japanese Imai (1986) support this:

> "It dawned to me that there might be different kinds of change: gradual and abrupt. While we can easily observe both gradual and abrupt changes in Japan, gradual change is not so obvious a part of the Western way of life. How are we able to explain this difference?"

Business process redesign contained another related feature that goes against the original assumption behind quality. Armistead and Rowland (1996) state: "…business processes can be broken down into a hierarchy of smaller processes which share the same characteristics". This is an analytical approach, closely related to thing metaphysics. The general direction of examination is towards breaking up entities into their constituent parts, where as no or little attention is given to relations between entities (or their parts).

As evident from Deming's characterization of the implications of dividing the productive effort into tasks (presented above), a central consequence of process metaphysics is that collaboration between tasks (operatives, firms, etc.) is the default situation, rather than an exception. This idea has not been properly acknowledged in the ISO centred quality approach. A list of quality principles has been developed in connection to ISO standards, and the latest version includes the following: Customer focus, Leadership, Engagement of people, Process approach, Improvement, Evidence-based decision-making, Relationship management (International Organization for Standardization, 2015). While most other original starting points of quality are well represented, the important issues of collaboration and teamwork are in practice covered regarding the relations between a firm and its suppliers and other stakeholders only – not inside the firm.

DISCUSSION

At the origin of the quality movement, Shewhart defined quality through the value generation theory of production, and suggested the scientific model (later to be named as Plan-Do-Check-Act cycle, PDCA) as the epistemology for improving quality. Somewhat later, Deming recommended process ontology as applicable in the quality context. These prescriptions were not presented in terms of theory, epistemology or ontology but through models and verbal arguments. Perhaps partly for that reason, in subsequent developments these prescriptions were often forgotten or rejected. Especially, the ISO standard for quality management rediscovered the original PDCA epistemology only in 2015. In turn, an acknowledgement of the implications of process ontology has been partial at best. Thus, the degeneration of the original theoretical and philosophical foundation seems to be one of the longstanding problems in the area of quality. Arguably, the situation that these epistemological and ontological starting point have been implicit has contributed to these problems.

On the other hand, it has turned out that the value generation theory of production is a partial theory. As the success of the lean movement indicates, production should also be seen through the flow theory. The achievement of quality can, for its part, also be explained through this flow theory of production. However, there has been very little theoretical work both regarding production and quality, and thus the integration of theories on production has not been achieved. Lacking theoretical evolution is another long-standing problem that arguably has hindered the progress of quality management.

CONCLUSION

There is a perception that quality as a managerial focus has lost its attraction in the last two decades. In this presentation, the argument that weaknesses of the theoretical and philosophical foundation of quality have contributed to this lack of attraction has been

forwarded, along with supporting evidence.The findings call for a sustained effort to explicate and develop the theoretical and philosophical foundations of quality.

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