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Issue Article

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ON THE NEED FOR AN INTEGRATED APPROACH TO MATERIALS AND PRODUCT QUALITY MANAGEMENT

Abstract: *In this article, the authors came to the realization that an integrated approach to materials and product quality management has so far remained a "hedgehog in the fog." The reason is simple: most authors simply planned such research but never implemented it due to its complexity. Currently, this problem has become solvable because it is now manageable and a step toward a philosophical perspective is possible. Perhaps not everything will work out, but we decided to take the risk.*

Key words: *integrated approach, quality management, philosophical perspective, materials, finished products, hedgehog in the fog, integrated research, worldview, methodology.*

Language: *English*

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Introduction

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It's surprising, but nevertheless true, that research must begin in the classic manner with a statement and a general objective. Despite numerous studies on the topic formulated by the authors, and equally clear assessments of its comprehensive analysis, the problem of a comprehensive study of quality management remains a "hedgehog in a dense fog." The reason is simple: with the exception of the

work of BS Aleshin and his co-authors, the promise of a comprehensive study of the problem remains wishful thinking. The content of studies usually does not extend beyond one or two aspects of quality and the feasibility of quality management. Other perspectives are either declared or included in such a sequestered state that their presence is perceived as a kind of burden for the pleasure of engaging with the authors' reasoning on a topic that is undoubtedly relevant for all times and for any activity. This shortcoming is also inherent in our works devoted to the problem of quality. Our only excuse, to some extent, is that we have thus far avoided making claims about a comprehensive study of quality in the context of management. A harsh reaction from our critics is entirely possible and even predictable. They will likely throw our conclusions back at us, finding a weak link in our work. And rightly so. Others—and we, too—will heed the criticism and move forward, collectively solving what is beyond the power of individual researchers, even when they combine their diverse cognitive resources and when, as in our case, an industry specialist, a systems economist, and a philosopher come together. Quality management theory is based on the philosophical development of this concept. "Quality" is a philosophical category, and the extent to which the philosophical component is represented in quality management theory determines the solution to the problem at hand. In philosophy, there has never been a unified interpretation of quality, and there is no common understanding today. This leads to an important conclusion: before developing a quality management strategy, you must decide on which philosophical "shore" you intend to land on.

Quality is a general and sufficiently stable definition of a set of objects. Only forms of existence and their substance are more stable than quality—the only things that are immutable by definition. Quality, however, also flows along the river of time and changes. Quality changes within itself, shifting its states, and radically, losing its definition, transforming into a different quality.

Main Part

Differences in philosophical understandings of quality are due to the complexity of quality as a subject of study, but even more so they are a consequence of the philosophical worldview and methodology upon which it is formed. "Materialism," "idealism," "metaphysics," and "dialectics" are philosophical concepts well-worn by class ideology. Conservative philosophers did well in the Soviet era, erecting barricades from behind which they hurled arrows of wrath at their enemies, absolutizing the political underpinnings of philosophical movements. Critics, triumphant in the embrace of liberal democracy, who are dealing with the restless legacy, also appear in a less than favorable light. Inspired by "noble anger," they have essentially turned to the past, not so much "trampling" on this hated past as marking time, hindering the progress of the cognitive process. "Materialism," "idealism," "metaphysics," and "dialectics" should not be abandoned, but rather purged of their pseudo-ideological "husk," thereby revealing the rational meaning inherent in these phenomena. These concepts are a kind of "boundary pillars" of philosophical and scientific knowledge, warning, on the one hand, of the need to adhere to certain guidelines in knowledge, and on the other, requiring the development of conditions for boundary interaction. Boundaries in knowledge are intended not to limit, but to isolate one from another. Their rationality lies in the fact that they regulate the cognitive process. K. Marx, who wrote that Hegel's idealism was "materialism turned on its head," bears no responsibility for his followers, who simplified Marxism and, in particular, the philosophy of Marxism—dialectical materialism. The idealist Hegel is equally not to blame for the fact that Erich Mach took the idealist idea to the point of solipsism and, with his philosophical exercises, damaged the rationality inherent in the highest achievements of idealist philosophy. The history of philosophy warns anyone who has embarked on the path of knowledge: fear one-sidedness above all else. It inevitably leads to absolutism, a state of knowledge in which the natural connection between the ideal and the material is severed, preventing progress toward truth. Quality management begins with the philosophical—that is, the mental and methodological—orientation of the theory. There are no alternatives. In developing management theory, it is pointless to deviate from philosophical foundations. We must actively seek collaboration with philosophy, rationally interpreted. The question of where this rational philosophy is located has long been rhetorical, since the time of the first philosophers. It has not existed, is not, and will never exist in its ready-made form as a "magic wand," a "magic tablecloth," or a "philosopher's stone." A rationally interpreted philosophy is an exclusive product of the interaction of professional thinking with philosophical heritage. Objections like "not everyone can do this" are entirely appropriate. True, everyone has this ability, but not everyone takes on the responsibility of building a quality management system. Most wait for instructions and regulatory documents in full. As is currently fashionable: a briefcase full of documents. Our Russian market has not only ugly torn the national economy apart, giving some fat morsels, but also leaving others with the elusive hope that one day their lean life will change and a new life will come. The Russian market has deprived us of national unity, devaluing what is widely known as the "enigmatic Russian soul"—or, simply put, our inherent desire to reflect on life in general, including

personal and national issues. A German is distinguished by law-abidingness, an American by adventurism, and an Italian by spontaneity. Our ancestors were defined by a sense of responsibility that is fading before our eyes. The philosophy of quality is a collective, synthetically constructed concept. Understandings of quality in various philosophical theories vary significantly, as they are tailored to the system and method used in its development.

In such an ambiguous situation, one must begin with the conclusion: everyone is right and no one is wrong. "What kind of gibberish is this," someone accustomed to thinking according to the inherent "either-or" formula will say. "We don't need riddles; we want everything to be based on the principle: 'to each his own.'" The task is precisely to put everything in its place. It's simpler, clearer, and you can't make mistakes. Formal logic of thought develops spontaneously, reflecting the world of things as a first approximation, roughly. F. Engels rightly compared it to elementary mathematics, which is incapable of describing processes and is therefore limited to operations with finite quantities. "What is good and what is bad" is the domain, formally, of logical reasoning, for which "every cloud has a silver lining," or "two different sides of the same coin" are judgments that are illegal and forbidden. Political ideology also imposes restrictions on thinking, dividing thoughts into one's own and those of the enemy, right and wrong, forcing public consciousness to operate according to the simplified rules of the formal logic of individual thought. Logical blinders are justified, pseudo-ideological ones are unjustifiable, as are the actions of those who stun views that differ from their own ideology, unwilling or unable to critically evaluate them. The Marxist and Hegelian concepts of quality have more in common than differences.

The main point is that the most essential understanding of quality coincides. K. Marx and F. Engels, distancing themselves from Hegelian idealism, ardently defended his dialectical understanding of thinking, developed his propositions, and defended them from criticism. They, better than anyone, understood the potential inherent in Hegel's dialectic of knowledge. For Hegel and the founders of dialectical materialism who wrote after Hegel, quality was:

- first, a set of essentially interconnected properties of phenomena;

- second, they understood quality as an objective state, even when it is created by human consciousness, since consciousness creates quality in accordance with the objective order of the world. Quality is invariantly objective;

- third, in their understanding, quality changes in accordance with the dialectic of the world's development.

It has a concrete historical mode of expression. All three of these characteristics of quality form the methodological framework: theories of quality and quality management strategies.

H. Hegel's famous predecessor, the English philosopher John Locke, also contributed to the philosophy of quality. John Locke divided quality into two groups: the objective qualities of things, which are essentially inherent in them, and qualities that arise in the process of cognition. The latter are absent in things, but are formed through the interaction of things and human feelings. Things excite certain feelings, and these feelings respond by creating qualities—sensations—corresponding to the received signals. Only the laziest have failed to criticize John Locke's duality of quality theory. He suffered from the materialists for his concessions to idealism; the idealists also didn't spare him for his group of objective qualities. Does such vigorous criticism of the English thinker's beliefs mean he was wrong about everything, lost in the thicket of the philosophy of quality?

Not at all. The ideas of an intelligent person cannot be foolish unless they are a joke, and John Locke was not joking. The philosopher sought to resolve the contradictions in the development of the theory of quality. He was dissatisfied with the view of quality of either simplified materialism or subjective idealists, whose judgments led to a dead end. John Locke was far from uniting the ideas of opponents and using such a primitive approach to overcome the existing conflict. He wanted to emphasize the role of consciousness in the history of the formation of quality, the activity of the subject, but he was unable to consistently implement his plan. The essence of his initiative—the desire to include the activity of the subject in the theory of quality—deserves special attention. Time passed, and the idea matured under the influence of practical factors. Philosophers returned, no, not to the philosophy of John Locke, to his idea of the activity of the subject and the role of its activity in shaping the quality of things. Not to mention the fact that the problem of the unique quality of the activity itself that creates quality in things has also become relevant. It's enough to recall the modern, international quality control system ISO 9001-2015. Its core concept is precisely the idea of quality in activity. It would be a mistake to equal quality with a thing. As a specific combination of properties, quality, by definition, is not the same as a thing. Hegel defined the quality of a phenomenon simply and, within the framework of philosophical understanding, which in market conditions aligns with consumer evaluation, with the concept: "quality is that without which an object ceases to be itself." It "ceases to be itself," but does not cease to exist altogether. By failing to meet quality requirements, a phenomenon transforms from one state to another, or into a different phenomenon.

An expert examination concluded that the product did not meet technical (and consumer) parameters. The product was reclassified as substandard, a defective item, but the thing remained, along with some prospect of its disposal: eliminating the non-compliance with the standard, recycling. You can't wear shoes, you can try to bail water out of a leaky boat with them, tamp down tow, chat, and who knows what a useless boot can be useful for in a big household - you can even put it on a samovar.

It's a mistake to separate quality from its object, not only from a philosophical perspective but also from a non-philosophical perspective. Otherwise, quality will become something independent, like "The Nose" in NV Gogol's story, and quality management will lose its objective definition. F. Engels emphasized: "There are no qualities, only things that have quality, and an infinite number of qualities at that." Experts note a shift in market towards demand quality products. The market is maturing. This is confirmed by demand monitoring. In this long-awaited situation, it's important not to lose philosophical ground when developing a business plan in accordance with the new circumstances. Quality is both the highest and permanent goal, so one must be oriented toward the future while the other is shaped by the present. Only a proper orientation toward a specific time, as a life span when it is most relevant, guarantees successful product sales. Manufacturers and sellers must be modern. Their modernity stems from the ability to find the optimal product range and match a specific product with the expected quality level, thereby achieving the optimal price range dictated by the consumer's effective demand, which expresses their need for the product. Quality for the consumer is not an abstraction created by the professional thinking of the manufacturer. Consumers view quality through the lens of their wallet. As long as the market exists, price remains its calling card. If a buyer first asks to see a product and only then asks how much it costs, then rearranging the elements of behavior does not change the outcome. The client will inevitably ask their sacramental question, the answer to which will determine how the transaction will be resolved. Quality is not adapted to independent existence. A thing—a commodity—is presented as quality when it appears on the market. And this is where the most important aspect of quality theory begins, so let's pause and examine the problem in more detail. The quality of things that make up nature arose naturally, spontaneously, according to a complex combination of natural laws. It follows that the quality of such naturally created phenomena is unequivocally objective in all respects. The history of the quality of phenomena created by human activity is different. The spiritual component of humanity is realized in social practice. People build houses, sew shoes, and clothes, aligning their actions with the mechanical, physical, chemical, and biological properties of natural objects. But we do not create the final product for nature—let's leave aside specific cases. We realize our goals, needs, and interests in the thing we create, its properties, and its quality: we either materialize or objectify them. In the quality of things produced by human practical activity, in the quality of this activity itself, the objective properties of things and the subjective forms of human existence are intertwined and fused. The quality of man-made things is objective, but their objectivity expresses the rationality (or unreasonableness) of humanity. And here lies the knot of contradictions between producer and consumer. It can only be resolved by aligning the manufacturer's views on the consumer properties of the product with a realistic assessment of consumer needs and capabilities. Product quality should be developed exclusively with careful marketing monitoring in mind, while production reserves are increased accordingly. We continue to observe a fragmented market mechanism. This explains the problems with the sale of domestic products. Professional activity, like a sculptor, molds the quality of an object, relying on the natural properties of the material, elevating them through talent and labor to a state that awakens a specific interest in the mind. Objects of natural origin also attract human interest through their ability to evoke aesthetic feelings, have a therapeutic effect, and serve as a material or a prerequisite for everyday production. This is understandable—humans "emerged" from nature, remaining a special part of it. However, their quality retains its "natural purity." Professional activity is a systemic factor in ensuring the quality of a product with added value. According to the regulations, it should also be the initial link in the development of a quality management ideology. Only high-quality professional activity can produce a high-quality product, namely:

• this is the first and fundamental law of production quality. Natural disasters are capable of much. People use them to acquire precious stones, methods, and building materials. A diamond is a product of nature's elements. The mineral possesses an original, unique, natural quality, but diamond jewelry builds upon this natural quality with so many new qualities of human interest that the natural quality essentially remains important only to those who process the natural stone. The final diamond product, whether jewelry or an industrial element, is the result of professional work. In the gemstone market, there are differences in interest in the source material—its deposits—but most importantly, in who will transform the rough diamonds into brilliants. The quality of a diamond is determined by the combination of raw materials and craftsmanship. And since the craftsman selects the raw materials, the contribution of their professionalism to the quality of the product is decisive.

• Hence the second law of production quality: to ensure product quality, high-quality training of specialists capable of preserving and enhancing professional skills is necessary.

• The third law of production quality requires that professional work be focused on improving the technological process through integration with science and technological progress. The concept of "quality," reflecting the world's objective diversity, must therefore reproduce objective distinctions within itself. This is achieved through the structuring of quality .

The structuring of quality is a particularly significant factor in quality management theory. It is useful to divide quality into the following seven structural levels, based on the significance of the human factor's contribution:

— Quality of natural objects;

— Quality of natural materials;

— Quality of processed natural materials; Quality of technical equipment;

— Quality of software;

— Quality of production activities;

— Quality of production organization and management.

Organizational and management activities aimed at producing a high-quality, marketable product themselves require quality assurance. Auditing the quality of organization and production quality management presupposes the structuring of the corresponding activities. The logic of creating quality in human-made things pushes the quality of activity to the forefront, focusing research attention on the characteristics of quality activity and the need to build systemic relationships between them. Philosophical literature on this topic is largely silent. Philosophers are still at war. Proponents of the objectivity of quality demonstrate the inconsistency of their opponents' views, instead of considering quality not only in the context of the objective reality of the world but also in the context of human, professional activity that transforms the material world. It is impossible to develop a scientific and philosophical doctrine of quality in the spirit of pre-Marxist materialism, for the old materialism was, essentially, a philosophy of contemplation, not of transforming the world. It was not for nothing that K. Marx taught: we must not only reflect the world, but also change it. Dialectics—a materialistic worldview—is based on the practical interaction between man and nature. Activity, primarily creative activity, is the credo of dialectical philosophy and science. The universal model of the relationships between the systemic properties of professional activity is explained by the diagram we have already presented and proposed:

The attributes of professional activity included in the framework are well known. They are commonly associated with professionalism in both scientific and practical thinking. The novelty lies not in the attributes themselves, but in their presentation as a systematic entity, which imbues them with a new level of meaning. When representing a system, researchers typically cite Bertollanffy's discovery of the systemic relationship of properties: the divergence between the sum of the attributes of a system and the sum of the attributes of the elements that make up the system. This effect, described by Bertollanffy, allows us to judge the systemic organization of properties, actions, and phenomena as the most effective form of relationships, which is important for management effectiveness, on the one hand, and for organizational excellence, on the other.

Quality management, building on its philosophical interpretation, takes the next step toward the systemic organization of an activity program, understanding the arrangement of systemic attributes of activity so that the resulting system is sustainable, relevant, and reasonably safe. A systems approach is currently the highest-quality method for understanding and organizing the management of any complex activity. There are probably no doubts about the superior effectiveness of a systems approach. There are those who inadequately perceive and appreciate the undeniable advantages of the systems approach, exalting its value to the detriment of other methods, particularly the integrated approach. The integrated approach, both in theory and practice, has not lost its value in competition with the systems approach. They combine quite well, complementing each other and enhancing the effectiveness of both organizational, managerial, and cognitive activities. It is more convenient to analyze the quality of activities from the perspective of the systems approach. It seems to us more reasonable to build quality management theory on the foundation of an integrated approach.

The current situation in specialized – not philosophical – knowledge (and in practice as well) compels us to return to the distinction between integrated and systems methods, as these methods have become too frequently interchanged. The systems approach is fundamentally distinguished by its method of constructing knowledge, in which the relationships between the elements and attributes that form phenomena are built on a basic relationship called the system-forming factor. The system is formed, similar to the process of crystallization, through the sequential addition of its constituent parts. It makes sense to systematically develop, for example, leather, fur, and textile products, where a certain agreed-upon material quality level is taken as the system-forming factor and the entire product range offered for production is "tied" to it. Quality and market position in this case will be determined by the quality of the corresponding material level used in the manufacture of each specific product range. An integrated approach is based on a specific qualitative

foundation and requires a comprehensive analysis of the quality of the phenomenon, with research aspects being both equivalent and dependent on some ranking.

A good example of the use of an integrated approach is the development of quality management. Schematically, it looks something like Figure 1.

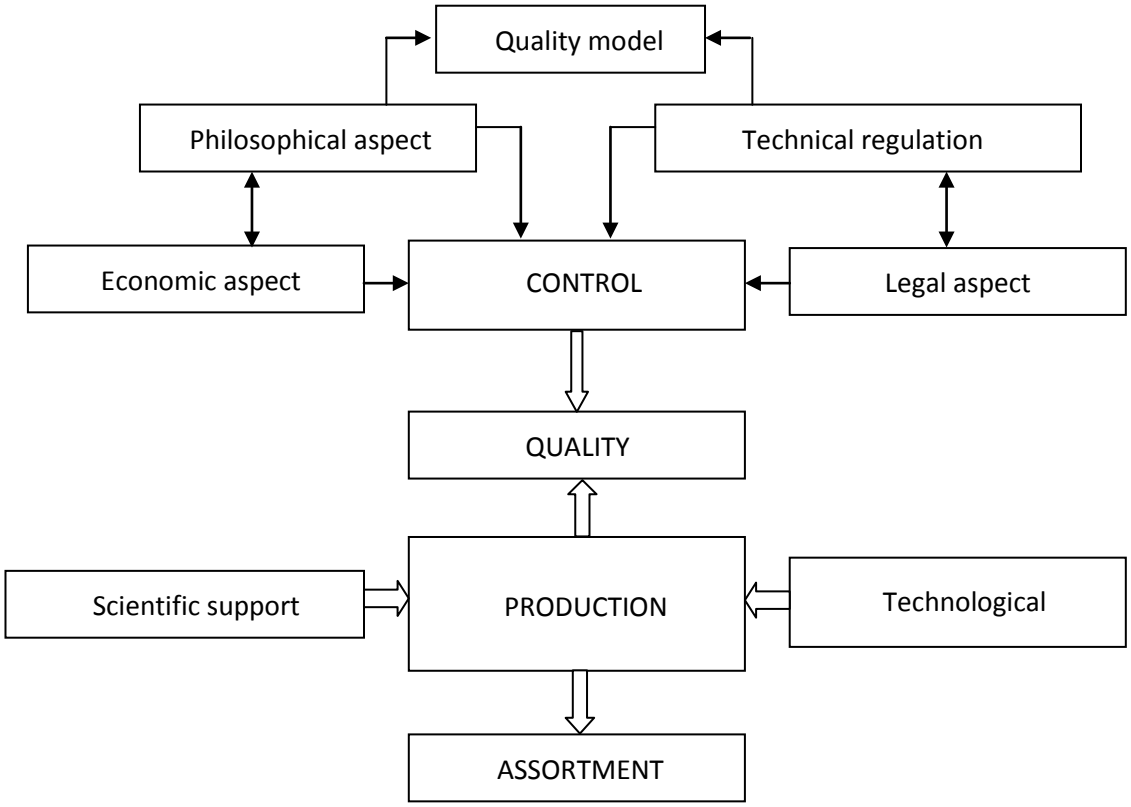


Figure 1. Schematic diagram of integrated production quality management

The diagram above demonstrates the interconnections and roles of the key elements involved in preparing and implementing the production quality management process. It clearly demonstrates the key relationships: the connection between the philosophical aspect and technical regulation, allowing for the concretization of methodological and theoretical developments to the level of normative and technical specifications; technical regulation with the legal aspect, including the use of patented and licensed elements; and philosophical and economic analysis, which provides the former with a specific subject orientation in market conditions, and the latter with a methodological perspective, emphasizing the dependence of production quality on the technological state of production and scientific equipment. A fundamental diagram of the interconnections between philosophical concepts describing quality, linked to economic categories, will help complete the philosophical analysis of quality at the level necessary for the practical application of this knowledge in the economic management of production quality. We developed this diagram several years ago. Our return to it is forced. The reason is that we were left with no choice. Philosophers continue to analyze quality, abstracted from specific forms of economic practice, in light of their professional interests. Economists conceptualize quality in a narrow, empirical sense, driven by mercantile interests. Philosophy cautions that the objectification of quality makes real sense only in its epistemological context: when addressing the nature of quality. Indeed, in the context of the "object-subject" relationship, quality is primary—it is objective by its very nature. Even when constructing quality, we are deprived of absolute creative freedom. Professional creativity is limited by the objective roots of the quality it creates. The quality of both things and theories is objective, with the only difference being that the quality of a thing is objective in material terms, whereas the quality of a scientific theory is objectified by the adequacy of its reflection of the objective quality of the thing, the relationships between which are reproduced in the scientific theory. The quality control system is shown in Figure 2. In quality management theory, it is important to correctly understand dialectics as the organization of production; as an activity organized by production; and, finally, as a produced good—

objective and subjective. The prominent Russian scientist and public figure LP Krasavin coined the term " kachestvovanie " (quality development) to emphasize the active nature of quality, linked to the subjective creativity of a professional. The subjective aspect of product quality is revealed in the marketplace through complex relationships between creators, intermediaries, and consumers. These relationships intersect with distinctive national mentalities: in the United States and Western European countries, a pragmatic, utilitarian approach dominates the interpretation of quality in the marketplace. In Russia, the traditional approach to product quality has been contemplative. Even today, for most Russians, quality goods are more than just something intended for consumption.

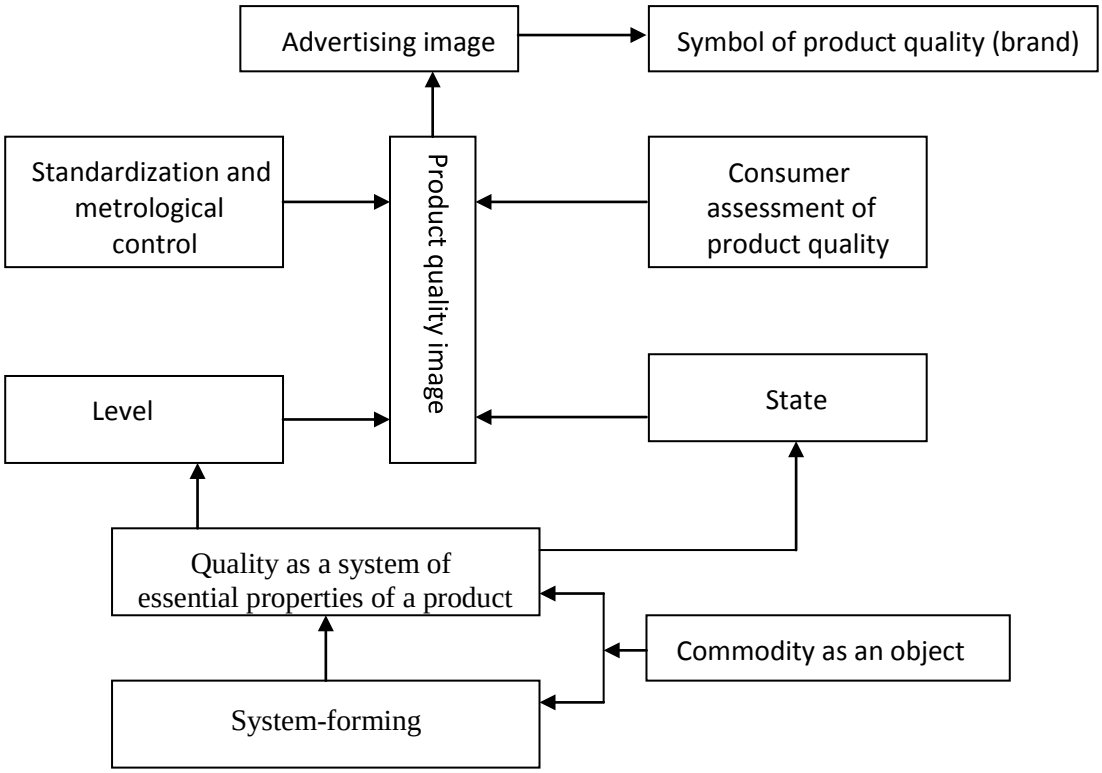


Figure 2. Quality control system

Creators and producers of quality goods must cultivate the awareness of potential consumers, recognizing that in a marketplace, product quality is a collective image. While the image of a quality product or brand name can certainly be promoted through advertising, such one-sidedness is uninhibited and dangerous. The sustainability of a quality product's reputation is ensured by the entire marketplace, including its extensive infrastructure. An educated consumer actively participates in the "fight" for quality. The market needs them, like a pike in a pond, to keep a crucian carp awake. A reluctance to spend substantial resources on educating consumers, a desire to “cheat” them with false, superficial advertising, will inevitably boomerang. Unfortunately, many Russian manufacturers aren't afraid of the boomerang. They know they won't last long in this sector. By the time the market sorts everything out and responds appropriately to pseudo-quality, they will be different, and this "nonsense" will lose its relevance. Although experts believe the Russian market has shifted toward product quality, the objective market situation has not changed significantly. The small percentages on which these encouraging conclusions are based are far from being qualitative characteristics. The solvent demand of the overwhelming majority of Russian citizens does not allow them to focus on product quality. A shift toward interest in product quality must necessarily involve expanding the range of products available to the mass consumer, but Russians have not yet completed this stage. This, however, does not mean that product quality has become irrelevant.

Integrating the above, we present formula (1), which allows us to identify the components of product quality, that is, a product produced by humans to satisfy specific needs. This formula can also be applied to natural phenomena integrated into market relations: clean air, mineral springs, therapeutic mud, clay, warm sea water, etc., as well as those whose production is not intended for sale. These cases are considered simplistic, subjective components.

$$CT = \underbrace{\sum ec + Д}_{} + \overbrace{C_П + P}$$

Where CT – quality of goods; objective component.

$\sum ec$ – the sum of the natural properties of the material;

D – activity, natural prerequisites are transformed into goods;

$C_П$ – buyer's consciousness;

R – advertising support.

The graphical equivalent of formula (1) is shown in Figure 3. This formula also describes the quality of an intellectual product. This requires expanding the definition of "natural properties" to include the intellectual and psychophysiological prerequisites of creative activity. The economic understanding of quality, upon which all known concepts of production quality management were directly developed, evolved according to dialectical laws, despite the fact that economists themselves were not always aware of the dialectic process.

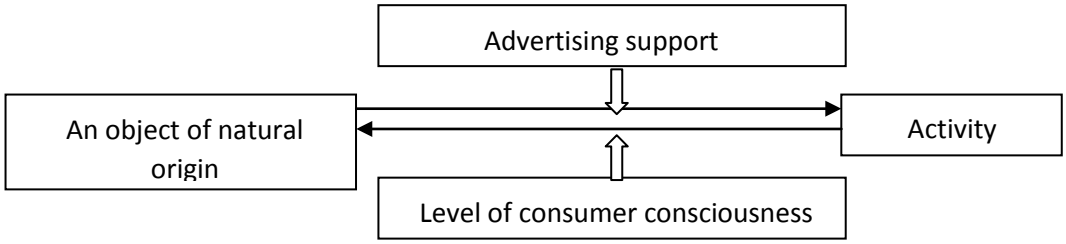


Figure 3. Graphical equivalent of the formula above.

The development of economic awareness of quality was driven by "the contradictions between the internal and external goals of the producer—ensuring the quality of manufactured products and, accordingly, strengthening the producer's position in the market (external goal), as well as increasing production efficiency, that is, increasing company profits (internal goal). At each stage of production, the market, and society, this contradiction had its own specifics and was resolved differently." B.S. Aleshin identifies four phases in the development of the modern philosophical and economic interpretation of quality, namely:

- "culling phase";
- "quality management phase";
- "phase of continuous quality improvement";
- "quality management program phase".

The history of economic quality management dates back to the era of guild production. Guild organizations were a must in medieval cities, one of whose most important functions was the certification of craftsmen. To become a recognized craftsman, one had to pass rigorous quality testing of their products. All products of guild masters bore the author's "hallmark" and were unique in their kind. Quality management was simplified by the production itself, its manufactory nature, which prevented large-scale production. Naturally, no agreed-upon quality standards existed at that time due to the difficulty of comparing strictly individual products of craftsmen, much less attempting to develop a model for imitation. The uniqueness of a craftsman's work precluded imitation altogether.

It was only much later that Colt's arms factories began standardizing product quality. This unusual approach was prompted by the fact that, under mass production conditions, the final product was no longer assembled from specially made and customized parts, but from randomly selected parts from the corresponding batch. For the first time, production was equipped with special gauges, and trained inspectors used them to check parts before assembly. The idea of standardization flourished during the era of automobile production in the United States. H. Leland, the founder of Cadillac, devised a pair: "pass" and "no-pass" gauges. H. Ford, having built the assembly line, took it a step further. He replaced incoming component inspection with outgoing inspection, allowing calibrated, high-quality parts to be delivered to the main production line—the assembly line—significantly increasing labor productivity and significantly improving the quality of the final product. Ford's factories also pioneered the creation of a quality control service independent of production. Henry Ford's associate, F. Taylor, who worked in close collaboration with his patron, undertook significant work on the scientific understanding of innovations in production. Ultimately, he succeeded in formulating the principles of scientific management focused on production quality: a systems approach; human resources management; the mandatory division of

responsibility between performers and organizers in achieving high-quality and efficient work; and the need for scientifically based labor standards.

F.W. Taylor, the undisputed founder of scientific Management. He was the first to discover the "exhaustion" of the effectiveness of the fundamental principle in management practice: "initiative – reward" for quality work. "In contrast," argued F.W. Taylor, "the development of scientific labor management suggests the development of numerous rules, laws, and formulas that will replace the personal judgment of the individual worker and which can be usefully applied only after systematic recording, measurement, etc. of their effects has been carried out." One cannot but agree with D.M. Gvishani's summary that, in the strict sense of the term, Taylorism boils down to the following:

— creation of a scientific foundation that replaces old, traditional, practically established methods of work, scientific research of each of its individual elements;

— selection of workers based on scientific criteria, their training and education;

— cooperation between management and workers in the practical implementation of a scientifically developed system of labor organization;

— equal distribution of labor and responsibility between management and workers.

F. Taylor himself envisioned the guarantees of production quality and efficiency as follows: "Science instead of traditional skill; harmony instead of contradiction; cooperation instead of individual work; maximum productivity instead of limited productivity; the development of each individual worker to the highest possible productivity and maximum well-being." Try to argue with F. Taylor. It's no wonder his views on the organization and management of machine production captivated his contemporaries.

Some believe that the concept of F. Taylor, G. Ford, A. Foyle, and M. Weber "has survived in its basic features to this day and has become the model for organizing production at most modern enterprises. Only in the 1970s did it begin to be replaced by another concept – the Toyota Production System." The ideology of the "rejection phase" was simple and clear: only high-quality products should emerge from production; the consumer and defective products should not be allowed to meet. Management efforts should focus primarily on component quality control and finished product assembly. The relative simplicity of the "rejection phase" concept lay in its reliability, and its relative reliability necessitated subsequent innovation. The reliance on the "rejection phase" in production quality ideology has had practical effects. It would be surprising if the results were not positive. Increased attention to quality control is a logical prerequisite for the functioning of production. This demand for market-based understanding has accompanied the development of manufacturing activity throughout its existence. The sustainability of the economic (and, to a certain extent, social) impact achieved by the pioneers in developing a scientific solution to the problem of production quality management is astonishing. And yet, the previously hidden side of the "rejection phase" was bound to emerge. The shift in management to the phase of high-quality production preparation—essentially toward the special status of control functions—signaled an increase in the corresponding costs of ensuring high-quality products. Production quality and the quality of the manufactured products are integral, but not the same. The development of manufacturing is undoubtedly determined by the quality of the goods manufactured. E. Deming rightly placed "production planning that is not oriented toward goods and services for which the market demonstrates demand" at the top of his list of the "seven deadly diseases" of modern manufacturing. In the transition from an industrial to a post-industrial mass consumer society, production is increasingly becoming a function of the market. "The buyer is always right"—no matter how repugnant this well-known adage may be, a seller forced to adapt to customer demand has no choice. Manufacturers, for whom the "seller" is the "buyer," have no choice either. Product quality is the special "song" of production. However, a "concert" cannot consist of just one song. Production quality is also characterized by its economic efficiency. The pursuit of product quality cannot be a production goal in itself, otherwise, a good deed will turn into a fatal disease. Product quality cannot compensate for overall production inefficiency. Improving the quality of the final product always requires costs to ensure it, which becomes a challenge for developers of efficient production strategies. The goals of increasing production efficiency and improving the quality of the finished product were incompatible in the concept of the "rejection phase," so it was replaced in the 1920s by the "quality management phase." Its developers attempted to overcome the critical importance of product quality costs, evident in the "rejection phase." They were unable to resolve the resulting contradiction. They managed to mitigate it. Among the innovators in the reconstruction of the “rejection phase,” one who stood out was an employee of the technical control department of the American company Western Electric, V. Shewhart, who proposed a method for constructing diagrams, better known as the “W. Shewhart control chart.”

At first glance, the American specialist's initiative appears quite radical. Shewhart rejects the key quality control model of F. Taylor and G. Ford. The production process itself becomes the focus of quality management, rather than the pre-production

stage, where defective products must be rejected. Shewhart's system of methods was aimed at improving the technological process, which was intended to increase the output of finished, high-quality products. Shewhart's concept initially reveals a dialectical approach. His predecessors tried to "divide production into its components" and load them to achieve the desired result. Ultimately, they overloaded one of the peripheral components, and the entire structure became distorted. The pre-production control stage became the most costly, while the main stage—the technological one—became dependent on it and was pushed to the periphery of the management process, suffering unfairly.

V. Shukhart called "things" by their proper names and ranked the stages according to their rank, emphasizing the technological one. By simplifying the pre-production stage, he risked reducing the quality of components. In return, he hoped to gain gains in the core production chain.

By prioritizing technological improvements, manufacturers strengthen their production processes, making them fundamentally more efficient through improved organization and technical equipment. As for defects, it's more practical to monitor them within the production environment, relying on scientific research and the timely implementation of new technical processes, along with measures to ensure the quality of workforce preparation.

The primary object of quality management in W. Shewhart's concept is the production process. Its output is a flow of quality parameter measurements for individual products. Shewhart retires Ford's previous goal of "meeting tolerances." Ford's idea had served its purpose and sparked new thinking. In its place, Shewhart forms a tandem of goals: ensuring process stability and reducing stability variations. Shewhart considered the presence of variations to be a natural phenomenon. He even derived a criterion for process quality: process stability should be considered statistically. Variations in product parameters are nothing more than the implementation of a stable random process whose distribution function remains constant over time. Shewhart believed that variations in product parameters are the result of two groups of causes: specific and general. Specific causes are rooted in disruptions in the production process. They are identified using a control chart and are eliminated based on the chart's readings. General causes are embedded within the process itself. There are many of them, but individually they are not significant. The danger lies in the combined effects of these causes. Common causes of product parameter variations are the concern of managers, often highly skilled and qualified. Through their research and actions, they can limit the effects of common causes. In this regard, V. Shewhart made two valuable conclusions that should guide production managers:

- Firstly, identifying the culprits is necessary, but once we find them, we are rarely able to influence the situation. It is necessary to seek out the causes of the discrepancy and eliminate them, involving all participants in this process;
- Secondly, process variations become the source of defects and inconsistencies.

Shewhart's quality management system is a complex goal. By linking the amount of variation to the organization of the production process, W. Shewhart clearly recognized that reducing variation requires a new configuration of relationships among people involved in production.

The essence of such a new configuration should be comradely cooperation. People are united into teams by the very nature of production. W. Shewhart's system is a significant advance over F. Taylor's. F. Taylor emphasized the mechanism of action, while W. Shewhart focused on the mechanism of human interaction across the entire spectrum of their relationships: technical, economic, and psychological. B.S. Aleshin is absolutely correct when he asserts: "The concept of 'tolerances' (one of F. Taylor's most important inventions) undoubtedly remains in practical work. 'Tolerances' are the form, the language of quality requirements, the result of quality planning. What changes is something else: the juxtaposition of the tasks of planning, execution, control, and corrective action. Such tasks are performed by teams." A comparison of the two aforementioned economic quality management systems can be presented as follows (Figure 4).

Figure 4. Comparison of the systems of F. Taylor and W. Shewhart

At the same time, it should be noted that W. Shewhart's ideas and methods continue F. Taylor's desire to place quality management on a scientific basis and to utilize scientific methods in organizing production. But here, too, W. Shewhart "leads" F. Taylor. For F. Taylor and H. Ford, science (and scientific methods) were limited to those concepts that allow for the quantitative measurement of the mechanical actions of an individual performer, the identification of an optimal route of movement, and the effective control of that movement, having first loaded it with a full program of tasks. The "classical" (Taylorian) theory of quality management was based on centrifugal forces and the movements of production: the division of labor, the specialization of actions, and the individuality of the performer. This one-sidedness was recognized by critics. W. Shewhart considered the mechanistic view of production development in general, and quality management in particular, to be a clear simplification . The production process not only unites the interactions of centrifugal and centripetal forces—individual and collective actions—it also defies the reduction of what occurs within it to mechanical relationships. Humans participate in production as subjects of actions and relationships. Moreover, humans, as subjects of labor, are the decisive factor in production. The development of production must be based on the development of the subject and the relationships between subjects. Subjective potential, in the form of individual knowledge, skills, and aspirations, is the main reserve of production efficiency, which science helps to activate and organize properly. In this understanding, science includes social and humanitarian components. An inherent flaw in the "classical" theory of production quality management is its oversimplification of the understanding and nature of human behavior in an organization. V. Shewhart understood this, explained it as best he could, and hoped to be understandable and relevant to practical management. V. Shewhart's new ideas did not go unnoticed by businesses, but apparently the inertial forces of business movement are so great that ideas begin to influence them only over time and ultimately. The shortcut to profit was habitually considered the simplest. Any complication is associated with additional costs. Will they be justified? Moreover, measuring the mechanics of action is much easier than the motivation for activity. But it is surprising that, almost half a century later, J. March and G. Simon noted that in the United States, two views on the position of people in organizations are widespread: "viewing the employee as an inert instrument performing a designated purpose, and treating personnel as something given, rather than as a variable in the system." Another authoritative scholar, M. Hare, agrees with them: "There are implicit assumptions about man on which, as it seems to me, the classical theory of organization and management is based: he is lazy, short-sighted, selfish, prone to error, has poor judgment, and may even be a little dishonest." M. Hare's text explains that the classical interpretation of management organization remains quite popular in practical management. Three main tenets of the "classical" theory of quality management have not been eradicated to this day. They continue to impress, warming the patrons' souls, caressing their self-awareness, and bolstering their self-confidence in their chosenness. Everything is so well laid out, namely:

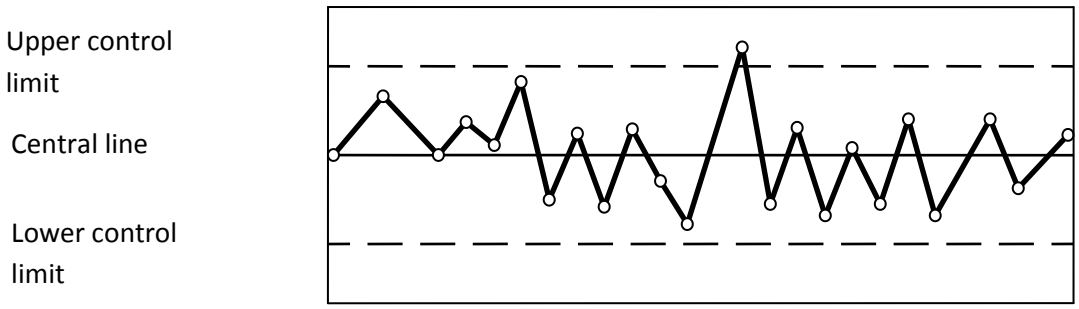
- the worker is an executor, essentially a “rational animal” with a clearly expressed dominant drive to maximize economic results;

- "each individual responds to economic incentives as an isolated individual";
- "People, like machines, can be treated in a standardized way."

W. Shewhart had many supporters who left their own noticeable and appreciated mark: M. Follett, E. Mayo, C. Barnard, F. Roethlisberger, and G. Simon. The 1930s were marked by the "humanistic challenge" of the "preaching of administrative responsibility." In theory, events unfolded according to a logical scenario. Practice, however, was not so receptive to changes in views, so the effectiveness of the new approach to economic quality management left room for reflection on the complex relationship between theory and practice. The structure of the economy itself hindered the comprehensive implementation of progressive ideas. For people to develop as subjects of production—to mobilize their knowledge—it is imperative that the economy turn its face toward people, to acquire a "human face." There is no other way to integrate individual talents into the fabric of production, to make them interested colleagues. Dialectics warns: truth is concrete. Theory is effective within a specific historical framework. Its life may be long or short, but it is always finite. The elements of theory and the experience of its application, expressed in historical lessons, continue to work, embodied in other, relevant theories and practical actions. Today's economic component of quality cannot ignore the achievements of W. Shewhart, M. Follett, G. Simon, and all those who demonstrated the need to engage the subject's ability to think and be passionate about the work in the struggle for quality. In particular, in our opinion, the power of W. Shewhart's "control charts" remains. They are simple and allow for monitoring the quality of the process and the performance of the performers. For the performers, they are more understandable than the manager's often unclear dissatisfaction, so we provide a sample of them (Figure 8).

By developing a model of a sustainable process, W. Shewhart significantly expanded the capabilities of scientific analysis of production quality, revealing aspects and stages of production that had remained obscured in the "classical" concept. He introduced the concept of "process adjustment based on measurement data" into the definition of production quality, which can be considered a concretization of the concept of "feedback" in quality management.

In the theory of random processes, the quantitative measure of the dependence of a sequence of random variables is the autocorrelation coefficient, which takes values from 0 to 1. When its values are close to 0 for adjacent observations (in practice, <0.2-0.3), the process is considered "white noise." If the autocorrelation coefficient values are close to 1, then various feedback control systems should be used for this process. It is easy to see in Shewhart's concept an attempt to theoretically understand the specific state of mass production of his time. He attempted to look at the assembly line through the eyes of science. And he achieved much. At least, W. Shewhart's ideas, although outdated, are still viable today. With a creative approach, they produce good results. A remarkable contribution to the practice of quality management was the creation of a quality audit service, the function of which differed significantly from the tasks facing F. Taylor's quality control departments. It was not engaged in rejection, but rather in verifying the operability of the quality assurance system by inspecting small production runs from batches of products. Thus, W. Shewhart found a way to reduce quality costs, which had increased disproportionately when organizing production according to F. Taylor's recommendations. However, W. Shewhart 's original thinking and organizational talent did not resolve the long-standing contradiction between the need to ensure production efficiency and the market's demand for quality goods, as well as the production itself's need for high-quality raw materials and components. Every production process has a limit to the output of quality products. This limit is not inherent in the process. It is an attribute of the system practiced at the enterprise, a product of all the combined activities, the specifics of labor organization and production management, including production quality. Approaching the limit leads to an escalation of the fundamental contradiction. Quality assurance requires ever greater resources, which leads to a decrease in production efficiency. In the 1950s, a new concept of quality management emerged, inspired by E. Deming. The name of the next stage in the development of a philosophical and economic understanding of production quality management underscores its essence: "the phase of continuous quality improvement." E. Deming's version of production quality assurance proved long-lived, remaining influential for nearly half a century, until the mid-1990s. We believe the continued practical relevance of E. Deming's concept can be explained by its skillful placement on the foundation laid by W. Shewhart and its subsequent development into a software product.



1 DATA COLLECTION: Collect data and map it

2 CONTROL : Calculate trial control limits from process data.

Identify and address specific causes of variation

3 ANALYZE AND IMPROVE : Evaluate special cause variations and take steps to reduce them

Repeat these three phases to continuously improve the process.

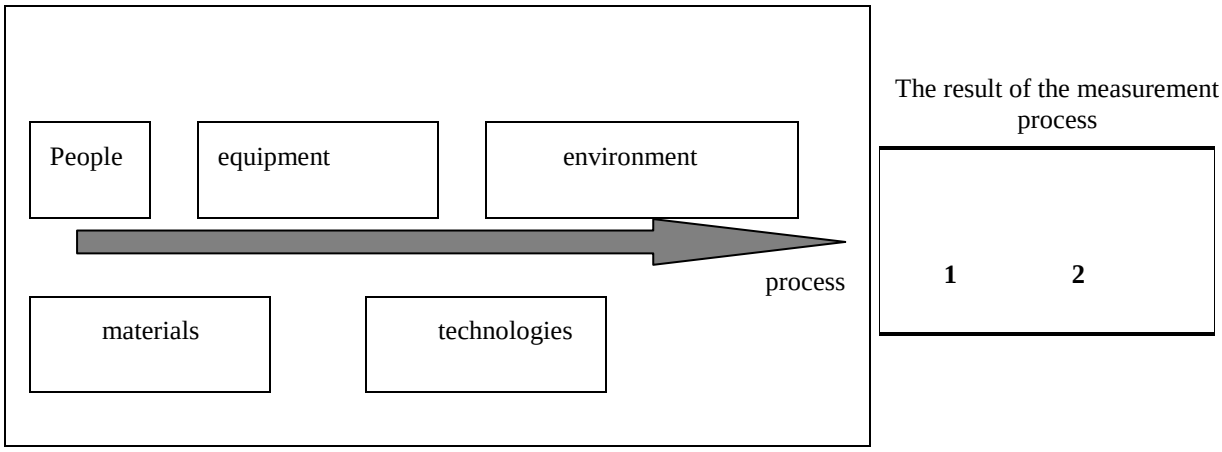


Figure 5. Shewhart's control chart

E. Deming's management program is built on three axioms oriented towards industrial practice, namely:

- The first practical axiom states that any activity should be defined as a technological process, from which follows the conclusion about the possibility of its improvement;
- The second practical axiom was formulated by E. Deming as follows: production has two states—it is either stable or unstable. In both cases, solving specific problems is insufficient; fundamental changes are necessary;
- The third practical axiom of E. Deming is this: the top management of an enterprise is obliged to accept responsibility for the result in all cases.

The practical concreteness of E. Deming's axioms is achieved within the framework of a special management program, which summarizes the theoretical and practical experience of organizing production quality management. The program represents several levels of understanding and practical implementation of ideas: "Fourteen Points," "Seven Deadly Diseases," "Difficulties and False Starts," "The Deming Chain Reaction," and "The Principle of Continuous Improvement (Deming Cycle)." The penultimate and final sections of the program are of particular interest for the practice of improving quality management in enterprises. The "Deming Cycle" is essentially a scheme proposed by W. Shewhart, which Deming also recognized. "The

Chain Reaction" is a product of E. Deming's own creativity. The Deming- Shewhart cycle consists of four stages, namely:

— observation;

— development of measures to improve the situation;

— implementation;

— analysis.

The task of the quality manager at the first stage is to collect information and identify weak production links that require restructuring.

In the second stage, the manager develops organizational measures aimed at changing the situation. This includes engaging all employees through motivation.

The next third stage is the implementation and monitoring of the modernization process.

The cycle concludes with a stage of analyzing the results obtained from implementation, building on experience to repeat the cycle. Perhaps the Deming- Shewhart cycle best graphically illustrates the development spiral, with each turn of the spiral being a relatively closed cycle of actions. The next turn "builds upon it," continuing the overall process. If it weren't for the tradition of naming such discoveries after their authors, the Deming-Shewhart cycle would be called the "spiral turn cycle" of quality management. The Deming-Shewhart cycle is undoubtedly relevant today for improving production organization, as it reflects the universal law of management design.

One cannot help but give credit to E. Deming for his development of the “chain reaction” in quality management, shown in Figure 6.

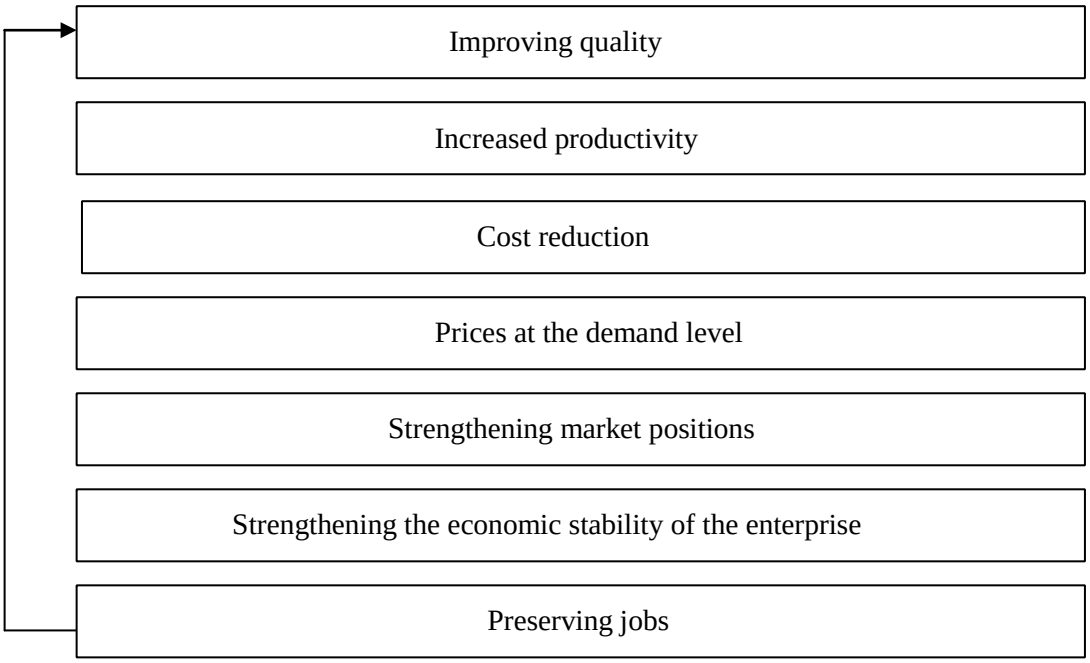


Figure 6. "Chain reaction" by E. Deming

In it, he linked economic and social actions, emphasizing the nature of historical time. The heyday of E. Deming's work is associated with the revival of the Japanese economy. The country's government and industrialists believed in E. Deming's arguments, and he deservedly shared the glory of the "Japanese miracle." His contribution is also evident in the achievements of Japanese specialists in improving production quality, which are clearly highlighted in the study by B.S. Aleshin and co-authors, namely:

1. Long-term, consistent and purposeful solution of quality problems based on all the advanced technologies accumulated by theory and created by practice in this field.

2. Consistent and persistent development of a system for studying consumer demands (prevention of the main “deadly disease of the economy” according to E. Deming’s classification – ed.), formation of a respectful attitude towards the consumer and his demands up to the cult of the consumer – (the consumer is always right – ed.) the consumer (in this case) is understood in a broad sense, as the next link in the technological chain.

3. Striving for total participation in achieving quality, from senior management to those performing specific tasks.

4. Understanding that even a well-functioning work organization system loses its effectiveness without constant testing and improvement.

5. Organizing quality assurance work directly with foremen and team leaders. Training, including special national television programs and national conferences for foremen and team leaders.

6. Particular attention is paid to mobilizing the physical and intellectual potential of workers. Quality circles are a group analysis of the situation in a specific area and the development of proposals for improving quality and enhancing the efficiency of processes and production.

7. Widespread development of a permanent system of propaganda of the importance of high product quality to ensure high rates of economic growth.

8. State influence on the radical improvement of quality, primarily for export products, including mandatory state certification. Attempts to export uncertified products are considered smuggling. State support for exports and assistance in promoting goods to foreign markets."

We deliberately chose not to abridge the section describing the Japanese practice of creating a quality management system because it, like a mirror, reveals Russian miscalculations—specifically, Russian ones. Having declared the Russian Federation the successor to the USSR, Russian politicians and economists close to them systematically destroyed the socialist experience of building production quality in the 1990s instead of rationally modifying it. In the 1990s, no one responsible for quality cared for it. The economy was reoriented toward raw materials, the quality of which was either determined by their natural origin or "compensated" by the quality they achieved.

A comparison of Japanese economic policy in the 1950s and later with Russian economic policy in the 1990s, heralded as a Russian revival, leads to a sad conclusion: grand pronouncements rarely match deeds. During Yeltsin's democratic reforms, politicians were least concerned with the interests of the Fatherland, and quality was completely ignored, squandering the previous national gains. However, the political assessment of this period in our history has long been given, and we are interested in the part of the theory that directly benefits the country's economy. In this context, it is appropriate to review a number of Japanese achievements, keeping in mind the possibility of drawing practical political and economic lessons from them. The overall conclusion is beyond doubt: economic effectiveness is determined not by the quality of goods produced, but by their variety and quality. Only those who oversimplified dialectics could have anticipated the transformation of quantity into quality. It is not quantity that is transformed into a new quality, but quality alone. The Japanese were taught by the Americans, but they learned very seriously from the experience—both positive and negative—of the Soviet Union. We, however, have still not made up our minds in practice. Our current declarations and certifications are viewed with skepticism by the entire world. Those who fail to appreciate and utilize their own achievements are incapable of truly mastering those of others. In Japan, the emphasis on quality has become a national idea, embodied in a "struggle" in which everyone, from the janitor to the CEO, relished participation. A system of mutual interests has emerged, supported financially, organizationally (career building), and spiritually. We continue our protracted search for an idea that would unite the nation. Quality is nowhere to be seen, even in the context of what is being proposed. It is not even considered a candidate for a national idea. Only enthusiasts seriously pursue quality, wading through the thickets of democracy, apathy, and so on. Our "helmsmen" have no time for quality. "Captains" continue to pave the way for the West and invest in economies other than their own. Paradoxically, foreign investment in the Russian economy will soon exceed that of our compatriots. Having lost the prospect of becoming an oligarch and feeling pressure from fiscal authorities, would-be oligarchs sought their fortunes in distant lands. The Japanese concentrated their capital in their homeland. Patriotism meant more to them than personal gain. This is the reason (and not the only one) for the "Japanese miracle." In 1945, the Allies destroyed everything on the Japanese islands except national self-esteem. And this became the launching pad for the country's revival. It should be emphasized that the Japanese actively sought specific mechanisms for transforming quality into the nation's overall interest in the practice of quality management in the USSR: "Personnel decide everything!", "Quality is the primary focus!", "Everything in the service of quality!"—these are slogans from Soviet history. And behind them stood strict party and state control. The Japanese subordinated all national and state (municipal) resources to the struggle for quality, forcing even television to work towards quality. Significantly, the media didn't limit themselves to advertising quality. They organized schools, courses, and universities to teach quality to key players: foremen and team leaders. National finances were channeled into education and training in quality work and its organization. What do we have? Quality is at the mercy of anyone who profits from training and education. What they've done is shoehorned the problem into a marketing ploy. We lack a national quality assurance program. Nor do we have a state-funded priority project (along with the well-known national projects). One gets the impression that, having officially declared support for international quality systems, Russia's top political leadership considered its mission accomplished, deciding that the market would regulate the rest. E. Deming's ideas were continued in the concepts of another American who worked on the "Japanese miracle," Yoshihiro Juran. Yoshihiro Juran shifted the emphasis in developing a quality management system from statistical methods to emphasizing the importance of the customer, dividing emerging problems into

random and chronic. Random (sudden) quality problems are one-off (one-off) in nature. They are not inherent to production. Random problems should be resolved routinely within the framework of ongoing management. To this end, it is necessary to clearly assign management responsibilities for implementing control measures and timely implementation of corrective actions. Chronic problems are a different matter. They are present in the process and, as it were, "planned" from the start. J. Juran understood chronic problems as the result of assumptions made in the preceding phase of the process.

Up to a certain point, such tolerances don't significantly affect quality; then, under the influence of implementation conditions and their own development, they acquire significant significance and become unacceptable. J. Juran "blamed" chronic problems for stagnation or loss of quality indicators. Company management shouldn't be complacent about good performance compared to the past. They must look forward, not backward, otherwise they can easily fall into a crisis. Management complacency is a "fatal disease" for production. Trying to solve chronic problems with orders is pointless. One must begin by identifying their root causes and sources. Knowing the causes, according to J. Juran, is usually beyond the capabilities of line managers. This requires a collaborative approach to analyzing the situation—a "brainstorming session." The second half of the 20th century was marked by the intensive intrusion of mathematical methods of process research into quality management. A new scientific discipline emerged—management decision theory, a development of operations research. In decision theory, decision making became the focus. It was interpreted as a process that could be quantitatively measured.

Work proceeded along two lines. Proponents of the first sought to find mathematical models suitable for use in real-world production situations (Fogal, Luce). The developers of the second turned to statistics and game theory, making extensive use of statistical testing methods (the "Monte Carlo method"). The one-sidedness of both approaches gave rise to a third school, whose founders sought to tie mathematical research as closely as possible to the problems of quantifying economic phenomena. This resulted in the so-called "econometric" approach to the analysis and management of economic processes, primarily production efficiency and quality. According to the above concept, an economic-mathematical model should have four components, namely:

1. It must include economic phenomena of qualitative content, expressed in specific units of measurement. Such quantities are the model's parameters;

2. It must include specific quantitative relationships and dependencies between parameters. These may be balance relationships or more complex dependencies linking process results to their underlying causes;

3. The model must define the area of acceptable changes in the model parameters in time, space and volume – "restrictions placed on quantitative dependencies";

4. It should represent a system of interconnected parameters, dependencies and constraints with defined inputs and outputs.

Controlling such a system, that is, achieving specific outputs, should be accomplished by influencing only the inputs, without interfering with its internal structure. The most famous economic models are attributed to L. Klein and A. Goldberg. V. Leontief, who received the Nobel Prize for his work, also contributed to the mathematical modeling of economic activity. The effectiveness of economic-mathematical modeling for relatively large-scale economic phenomena is not high. Without denying the importance of such modeling, the prominent economist T. Haavello wrote: "It is quite possible that as increasingly sophisticated methods develop, we will come ever closer to recognizing one unpleasant fact: economic 'laws' are difficult to measure precisely, and therefore we actually live in a world of large, but largely superficial or spurious correlations. One can, of course, cite, as always, poor statistical data. However, I think we can find explanations elsewhere, namely, in the imperfections of economic theories." Quality management is somewhat of an exception. Unlike the low efficiency of using mathematical tools when studying the economy as a whole or individual industries, the application of mathematics to quality management has proven quite acceptable. Both Deming and Juran actively exploited its potential. An analysis of economic strategy in the field of quality management shows that the effectiveness of quality management depends on consistent macro- and microeconomic perspectives. This is also evident from real-world Japanese experience. The solution to the quality problem itself requires a step-by-step approach, from problem identification, through diagnosis and search for solutions, to implementation, maintenance, and development of achieved results.

In the first stage, J. Juran called it "a problem with a pre-programmed solution." Problems are identified, priorities are determined, and a ranking order is established; executors and their responsibilities are determined. During the diagnostic stage, optimal symptoms of the condition are identified; hypotheses are developed and tested; and causes are sought. The solution-seeking stage involves, namely:

— finding optimal solutions;
— development of necessary measures;
— implementation of adopted decisions.

The final stage consists of verifying the effectiveness of the implementation results and comparing the achieved results with the planned ones. The high effectiveness of Deming's and J. Juran's concepts prompted F. Crosby to combine their systems with the quality management experience accumulated in the United States. Crosby's "Zero Defects" program was not fundamentally new in quality management theory, but it contained interesting ideas. For example, the assertion of defect prevention; the need to develop a "quality policy"; and the requirement to involve non-production units in quality management. F. Crosby believed that every technological area should have an engineer responsible for quality. His professional responsibilities include, namely:

1. presenting a daily list of issues that cause significant and frequent defects;
2. systematization of them according to their degree of importance for quality;
3. determination of corrective actions;
4. involvement of personnel employed at the site.

The "continuous quality improvement phase" helped overcome the contradiction between quality costs and achieving production efficiency. Consumers began receiving high-quality goods at an affordable price, bringing the idea of a "consumer society" closer to reality. From the producer's perspective, an ideal situation emerged. However, the assessment of the situation was one-sided, from the consumer's perspective only; quality parameters were not determined by the consumer, the target market.

Quality was standardized within the manufacturer's standards and, naturally, primarily reflected its own interests. Consumers were left with a choice: to purchase a product of a certain quality or not. This again led to production overheating and increased costs, as miscalculations in consumer needs were common. A high-quality product (according to the manufacturer) that was affordable failed to meet the necessary consumer demand.

This new form of contradiction had to be resolved with consideration for the consumer's interests. The "continuous quality improvement phase" gave way to the "quality planning phase." The work of G. Taguchi is considered the beginning of this new phase. He introduced the concept of the "loss function" into quality management theory and developed a modern methodology for planning industrial experiments. Taguchi 's research aimed to overcome the contradiction between quality assurance and production efficiency in its existing forms. The concept of quality planning was founded on four new ideas, namely:

- the conclusion that product defects are mainly due to poor quality actions at the design stage;
- A conclusion was reached regarding the need to focus core products not on full-scale testing of product models, but on mathematical modeling of both the products and their production process. This was expected to promptly identify and eliminate the causes of increased defects. It was proposed to bring design and technological processes under control before actual production;
- the idea that the concept of "zero defects" should be replaced by the idea of "satisfied customers";
- High quality of goods should be emphasized by an affordable price and constant price reduction, thereby ensuring a stable market demand for quality goods.

A new stage in the development of quality management has overcome the fundamental contradiction between quality and production efficiency, but not the contradiction itself. Currently, another "ecological" form is emerging. Incorporating environmental friendliness into product quality specifications requires significant investment. The uniqueness of the current stage of quality management lies in the fact that enterprises are practicing all known formulas. B.S. Aleshin, reflecting this unusual way of coexisting between history and modernity, constructed the "Quality Tower." It is of both theoretical and practical interest (Figure 6). In the 1970s, A. Feigenbaum summarized the accumulated intellectual and practical experience in developing the problem of economic quality management and laid the foundation for what is now known as TQC (Total Quality Center).

Essentially TQC – Total Quality Centrol is not a quality management system, but a system of sufficient conditions for a quality process. Development logically led to the development of TQC. All previous steps toward quality management, despite their progressive nature, were monotonous. They tied the solution to the problem of economic quality management to a specific fragment (or fragments) of the process. Thus, improving quality management bypassed the essence of the production process—its unity and the systemic nature of its unity as specifically structured connections and dependencies.

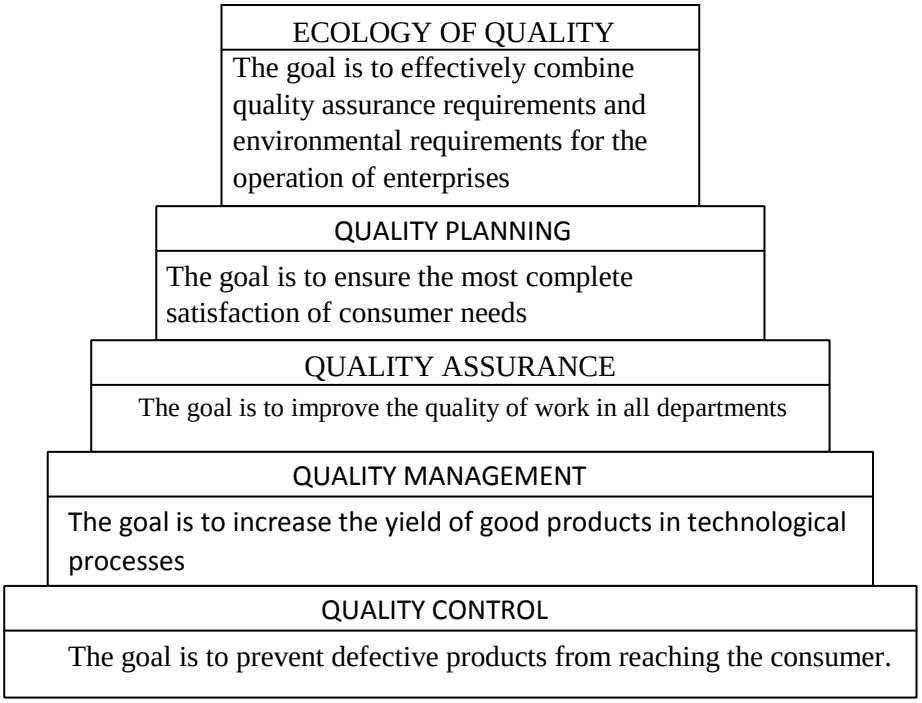


Figure 7. "Quality Tower" by B.S. Aleshin

Feyegenbaum came closest to understanding the quality system as a reflection of the production system. The following conditions can be considered the main conditions of TQC:

- Ensuring total participation of all employees in solving the quality problem;
- awareness of the total responsibility for quality of all participants in the process, understanding that no specialized unit (quality control, quality management, etc.) is capable of coping with the task;
- Compliance with quality standards across all stages of the product's life cycle: from product concept development and marketing research to product and packaging disposal methods. Given increasing environmental requirements in some countries, such as Japan, product certification requires mandatory development of a recycling method for even the packaging;
- total improvement of knowledge and skills of performers and managers; regularity of specially organized forms of advanced training; planning of corresponding costs;
- Achieving a comprehensive understanding that quality work is achieved not so much by technology and equipment as by focusing on the quality of employee motivation. This motivation should not be one-sided, focused solely on financial returns. Then it will be stable;
- Total structuring of activities, their differentiation into operations, interconnected technological processes, and transitions, with each process element clearly defined for its purpose by all performers. Studies on eliminating the causes of defects have shown that up to 90% of problems submitted for review are resolved, with 75% of these being resolved by controllers (direct performers and organizers) themselves;
- totality in the consumer's understanding;
- the consumer is not someone outside the production process, the consumer is each subsequent link in the production process itself - the “internal consumer”, therefore, an awareness of responsibility to the consumer throughout the entire production cycle is required;
- total cultivation of the special status of the consumer and his interest in the quality of the product;
- continuous quality engineering;
- understanding the importance of defect prevention and its economic advantages over defect elimination;
- team spirit of all participants in the process; corporate culture;
- leading position in quality assurance activities, top management, understanding of quality as a business goal.

Conclusion

In the 21st century, quality management relies on the reciprocity of total quality management (TQM) and quality system standards (ISO 8402; ISO 9000; ISO 9001). The main difference between quality system standards is that in many countries, including Russia, they have acquired state registration and are administratively enshrined.

Therefore, clarity in the definition and content of the concept of "standard" is important. In the USSR and the Russian Federation, it was common practice to assign a "quality mark," officially certifying that a product meets certain agreed-upon parameters. A "standard" in Russia and most other countries is a set of strictly defined, often administratively defined, characteristics of products, services, and activities. Analogues of our "quality marks" are found in European countries, particularly in Sweden (TCO 92; TCO 95; MPR for monitors). The concept of a "standard of technological modernity" (industrial standard) has been developed, and the Bologna Protocol is based on it. From the perspective of consumer interests, the "standardized" concept of "standard" is not as relevant as it is for the manufacturer. The latter, enjoying a head start, considers its own interests first. Hence the conventionality and relativity of any standard and "standard sign" until the standard balances the mutual interests of both parties: the manufacturer of the product and its consumer. The most widespread quality system standard, ISO 9000, is built on the idea of a special organizational system. The basis of this idea is the thesis on the documentation of all processes related to production: the procurement of raw materials and components; preparation of production organization; delivery of products to the consumer; provision of warranty support; scientific and technical equipment of production; HR management. As a result, the concept of "quality" acquires new facets, expands; the traditional understanding of quality is modified. The content of the concept of "quality" is loaded with knowledge corresponding to the changed situation. A classic example of the dialectic of concept development.

References:

1. Porter, M. (2025). *Competition* / - Moscow: Publishing house. Williams house, 2025 - 608 p.
2. Glushakova, T. (n.d.). *Measurements of consumer satisfaction and enterprise management* / - Retrieved from http:\\www.quality.eup.ru
3. Efimov, V. (2025). *Types consumer values products* / Moscow: Standards And quality - 2025 - No. 5.
4. Karsavin, L. P. (2025). *Philosophy stories*/ - St. Petersburg: JSC "Set", 2025.
5. Knorring, V. I. (2024). *Theory, practice And art management* / - city Moscow: NORM-INFRA, 2024.
6. Salimova, T. A. (2024). *Diversification management quality* / - Saransk: Mord Publishing House. University, 2024.
7. Shadrinsk, A. D. (2025). *Five needs, eight principles, Ten Commandments* / Moscow: Standards and Quality, 2025 - No. 2.
8. Rebrin, Yu.I. (2024). *Quality management* / - Taganrog: Publishing house of TRTU, 2024, 174 p.
9. (2025). *Efficiency and Quality Management.* Modular program/in 2 parts - part 1. Moscow: Delo, 2025 - 800 p.
10. Feigenbaum, A. (2025). *Product quality control* / - Moscow: Economica, 2025, - 471 p.
11. Salimova, T.A. (2025). *History of quality management* / - Moscow: Knorus , 2025, 256 p.
12. Ponomarev, S.V. (2024). *Product Quality Management. Introduction to Quality Management Systems* / - Moscow: RIA "Standards and Quality", 2024, 332 p.
13. (2025). *Imai, Masaaki Gemba Kaizen: The Path to Cost Reduction and Quality Improvement*. / - Moscow: Alpina-Business-Books, 2025 - 346 p.
14. (2024). *"What is Six Sigma? A Revolutionary Method of Quality Management"* / Moscow, Alpina-Business-Books, 2024, 158 pages.
15. Womack, J.P. (2025). *Lean Manufacturing: How to Eliminate Waste and Make Your Company Prosper* / - 2nd ed, Moscow: Alpina - Business - Books, 2025, 473 p.
16. George, L.M. (2025). *Lean Six Sigma: Combining the Quality of Six Sigma with the Speed of Lean Manufacturing* / Moscow: Alpina - Business - Books, 2025, 360 p.
17. Singo, S. (2024). *Fast changeover: revolutionary technology for production optimization* / - Moscow: “Alpina - Business - Books”, 2024, 344 p.
18. Vader, M. (2025). *Lean manufacturing tools: A mini-guide to implementing lean manufacturing techniques* / - Moscow: Alpina - Business - Books, 2025, 125 p.