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Science and knowledge in terms of quality and quality in terms of development of knowledge and science

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Abstract: *The paper starts with a dilemma whether the quality, as a circular logic of the process model, is a scientific discipline or just an art of achieving and satisfaction of requests and wishes of the customer. Beginning from that dilemma, a relationship between science, knowledge and the quality management system has been elaborated. That relationship has been articulated in this paper using examples of improvement as a key principle of QMS.*

Elaboration of the improvement system is based on QMS principles and requests of international ISO 9000 standards. Connection of requests for improvement and teamwork is a key for understanding of this process. It is associated by one more factor during the operation, also a key for its understanding. It is a training and knowledge, which are foundation of the philosophy of success. This work indicates that it is impossible to achieve improvements without training and new acknowledgements and teamwork. .

Paper especially refers to the issue of relation between improvements and application of scientific methods and creation of virtual teams structured by the„owner“ of the process and scientist from institutes and universities.

Improvement, training, science – improvement make a spiral of the success which when initialized generated new cycles of the improvement. If quality is based on continual improvements and dynamic process of acknowledgement and if it founded on scientific prevention, scientific design, scientific recognition and scientific application, does that make it a scientific discipline.

1. INTRODUCTION

Circle logics of the process model of quality, which start and end with continual improvements, structure the way of thinking of employees. Structure of thinking of employees makes the structure of thinking of a team; and structure of thinking of teams makes the structure of thinking of an organization. Philosophy of quality and theory of acknowledgement deal with structure of thinking, logic of improvement and virtues of work. Improvement as a continual process is leaned on the science of quality. V. A. Shuart believed in that eighty years ago. Deming and other theorists and practitioners of quality have elaborated his premises. But besides that, even today at the beginning of the twenty first century, there is a question whether the quality

is a scientific discipline or just an art of achieving and satisfaction of requests and wishes of the user. Even during nineties of the last century, certain authors have pointed to scientific approach to the quality management [1], while others had indicated that the quality was a solely an approach to management.

The beginning of the twenty-first century is characterized by a new general trend, evolving integrating technological approach to processes, supported by: information communications technologies (ICT), quality and scientific approach. This global trend has two general components: one is a general integrating technological component, and the other is a general integrating orientation towards human potentials. New technological and new managerial methodologies generate out of these trends.

At the same time, the end of the twentieth century is a period of development of quality standards and new approach to management. At the beginning of the twenty-first century, already during the first decade, more advanced quality management systems have been developed based on foundation of the quality management system [QMS]. That is a new philosophy of quality based on virtues of work in every process. It relies on uniform distribution of quality on every workplace. It is the Total Quality Management [TQM].

This paper elaborated relation between science, knowledge, and s quality management system [QMS], as well as other higher levels of quality, organizational excellence and TQM. Theoretically, it is not difficult to establish that relation. However, the purpose of this paper is to indicate mutual practical and active relations between science and knowledge and quality at all levels of an organization. Hereby one approach is indicated that has not been available up to now according to the literature we have at disposal.

Efficient and mutual relation, between the quality on the one hand and science from the other hand, can be established if it has been based on principles and requirements of QMS, and then developed through higher levels of quality.

This consideration applies the sixth principle of QMS, *continual improvements*, to articulate a relation between science, knowledge – quality. This principle has been transformed into numerous standard requests that are related to training, qualification and science in this paper. The paper uses experiences from the rich practice and examples from realized projects. Examples from literature were used, which are possible to implement in our conditions.

2. IMPROVEMENT – PRINCIPLES AND REQUESTS OF QMS STANDARD

Process and product improvement, as the very essence of organizational management and condition for survival, is based on eight principles of QMS, and particularly on the principle *continual improvements and process approach*. A starting point for improvement in all processes of an organization is recognition of user wishes, needs and demands. Based on these demands, needs and wishes, the quality is being defined.

Every employee manages some process alone or in a team. Process is managed according to the process model of QMS, responsibility for the process is clear, resources are managed, and product or service realized, results are measured, analyzed and the process is improved. That is done by the „owners“ of the process – one employee or a team.

Is it possible to achieve an ideal situation where all employees work on continual improvement of the processes they are in charge of. That is a strategic goal of an organization (ISO 9004 – Annex B – Process of continual improvement) to achieve better performances of the organization and benefits for all interested parties through realization of continual improvement of the process.

Standard ISO 9004 – Annex B indicates that workers employed in the organization are the best source of ideas for improvement. However, standard recommends that employees should be given authorities, technical support and necessary resources in order to realize improvements.

As if this recommendation indicates occasional

activity of improvement. QMS in its principles insists on continual improvements.

Standard ISO 9001 is explicit in request 8.5 that states: *„Organization must continually improve efficiency of quality management system using quality politics, goals of quality, monitoring results, data analysis, corrective and preventive measures and audit by management."*

The question is propounded what does it mean that *„organization must"*: and how that *„must"* is realized. Does that *„ must continually improve..."* refers to one improvement in the organization or the *„must"* refers to every process in the organization. It means that every employee has an obligation to permanently improve the process he is the „owner" of. The owner improves the process, then improves the improved process, then improves that already twice improved process and so on.

Improvement and improvement of the improved processes is a result of work by employees and the very essence of the management system. It is a work style and a way of the approach that develops:

- Team work, team is the „owner" of the process;
- optimism, improvement has a certainty and sense, usability and usefulness;
- submission, will and determination;
- discipline and personal competence and sense of value;
- kindness and sense of humor.

Diligent people that believe in progress improve processes. There can be no process improvement in absence of faith in man and progress.

Employee improves the process,
and process promotes the employee.

Processes of improvement and further improvements of improved processes do not evolve linearly and with ever increasing results. The first improvements are always „spectacular", but subsequently steps become smaller, then further smaller. That is to say, it is governed by Pareto's rules on decreasing improvements, which lead to saturation.

Saturation of improvements signals that the time has come to apply some decisive changes that would lead to *„revision or improvement of existent processes or implementation of the new processes..."* (ISO 9004, Annex B, Process of continual improvement). Decisive changes are certain processes, they are a small-scale reengineering with a certain outcome. That is not a „proposal for all or nothing with an uncertain outcome", such as is a reengineering suggested by Michael Hammer.

Quality improvement is achieved by the process improvement. Efforts for quality improvement should be focused on constant finding of possibilities for improvement instead of waiting for the problem to occur in order to find out those possibilities.

Preventive and corrective measures correct or lessen causes of the problem that has occurred, and thereby correct or lessen possibility of their recurrence, in this manner improving processes in the organization, which makes them crucial for the improvement of product quality.

Improvement demands an environment for open communication, teamwork, while respecting and encouraging individuals by giving them possibility to improve their own work processes. Condition for quality improvement frequently demands new group of value distributions, attitudes and behavior, directed to satisfaction of customer needs and setting of ever increasing goals. Values, attitudes and behavior that are relevant for continual quality improvement comprise [ ]:

- ◊ focusing of attention on satisfaction of both internal and external buyers needs,
- ◊ including the whole chain of supply into quality improvement, from a supplier to a buyer,
- ◊ demonstration of management orientation (leadership and participation),
- ◊ accentuation (emphasizing) of quality improvement as a part of

job of every individual or team work or individual activities,

- ◊ continual improvement of all processes,
- ◊ Introduction of an open communication with approach to data and information,
- ◊ encouragement of team work and respect of individuality
- ◊ decision-making based on data analysis.

Goals of quality improvement should be set within entire organization. They should be completely integrated within goals of overall operation and directed to the increase of buyer's satisfaction, effectiveness and efficiency of the process. Goals of quality improvement should be completely comprehensible, challenging, appropriate, and defined in such a way that their progress can be measured. All employees should take a part in formulation of the strategy for achieving these goals. Goals of quality improvement should be regularly audited and reflect ever changing buyers' expectations.

Application of any method gives an improvement of the quality system. However, full contribution of application of methods can be realized only if they are applied together. This requests organizing, planning and measurement of quality improvement, as well as revision of all activities undertaken on quality improvement. With a view to efficient organizing of quality improvement, possibilities for quality improvement that are vertical in the hierarchy of an organization and horizontal in processes that are going on within an organization. When organizing quality improvement, we should focus on the following:

- ◊ **means for protection of politics**, main goals of quality improvement of the strategy, general guidelines, support and broad coordination of quality improvement in the organization;
- ◊ **means for identification of needs** and goals for cross-functional quality improvement and resource distribution because of its monitoring;
- ◊ **means for monitoring of goals**, quality improvement through team activities within the area of their direct responsibilities and authorizations;
- ◊ **means for stimulation of every member of the organization** to monitor activities of quality improvement related to his work and coordination of these activities;
- ◊ **means of auditing and evaluation** of progress of quality improvement activities.

Organization should develop a measurement system that suits the nature of its works. System of objective measuring based on data must be set in order to identify and determine possibilities for improvement and measurement of the results of quality improvement activities. Well-developed system contains measurement per unit, department, and mutually dependent functional and all organizational levels. Measurements should refer to losses of quality related with user satisfaction, process efficiency and social losses.

Regular audit of quality improvement activities should be carried out at all levels of management in order to ensure that:

- ◊ organization of quality improvement operates efficiently;
- ◊ plans for quality improvement are adequate and followed out;
- ◊ measurements of quality improvement are appropriate and sufficient and indicating satisfactory progress;
- ◊ auditing results are included in the next cycle of planning.

It is necessary to set the plan and allocate proper resources. The purpose of this phase is to enhance understanding of the nature of the process that shall be improved by collection, confirmation and data analysis. Data collection should always be performed compliant with the carefully arranged plan. It is important to perform a survey of possible causes with the biggest objectivity, without any prejudice regarding what might have been causes of the preventive or corrective measure.

3. IMPROVEMENT AND TRAINING

In order to orientate an employee, disciplined optimist and diligent, competent „owner“ of the process, toward the improvement, the management conditions an organization to generate politics, goals and both customer and employees' satisfaction. Only in a stable environment, which means an ever-changing environment, it should be expected that all employees are oriented towards improvements whereby they increase their efficiency and efficiency of the organization and in that way contribute to satisfaction of requests and wishes of users and other interested parties.

Continual training and qualifying is of great importance for all employees. Programs for training and qualification are important for creation and maintenance of quality improvement environment. All members of the organization, including the highest levels of the management too, should be educated and trained relating to principles and practice in the field of quality, as well as the implementation of appropriate methods for quality improvement. Programs for qualification and training should be audited regarding their compliance with principles and practice in the field of quality. Efficiency of education and training should be regularly evaluated. Training without a practice is rarely efficient.

Considerations of the American scientist D. Garvin, namely that success of the movement for quality in Japan is a priori, achieved thanks to the large-scale training of Japanese managers and employees, were the ground wherefrom one of the best definitions of quality has originated from [ ]:
„ Quality is the ability of the organization to learn and implement customer's wishes.“

This definition can be altered in a number of ways, such as:
„ Quality is the ability of the organization to improve performances of the product, process and organization“ ,
or *„improvement is the expression of organization's ability to implement user's wishes. “*

If improvement does not take place in all segments of the organization, subsequently effects of the improvement in those segments of the organization where it did took place are being diminished. If there is no improvement, customer expectations are not met.

The higher the level of improvement is, further areas for improvement are more diverse and more comprehensive.

Improvement should contribute to fulfillment not only of user's wishes, but also requests and wishes of employees and other interested parties.

Continual improvement is the very essence of the new approach to management. **Continual improvement** is defined as one of the eight QMS principles and QMS principle of **factual approach to decision-making** is related to it. Improvement carried out in the field of QMS is simultaneously an improvement for other management systems (EMS, OHSAS, HACCP and others) as well. It especially relates to improvements that are established by process approach, i.e. within the process model. Processes of improvement within four modules of the process approach are practically inexhaustible. **It is an endless road**. The higher the level of improvement gets, spaces for further improvements get more and more diverse and comprehensive. Process approach as the articulating factor of the integration of quality management system is joined by techniques and methods that provide systems to be improved and integrated in a founded way.

Abundance of improvements is inexhaustible in the field of responsibility of management as a driving module.

Process that is not being improved, regresses.

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Top management is obligated to stimulate its own associates and middle management to apply techniques and methods of improvement. It is also obligated to apply those methods itself. The Top management applies appropriate methods in its decision making such as: SWOT analysis and Benchmarking. Middle management applies methods that are adequate for the contents of its decision-making, such as QFD, ISHIKAWA, PARETO, and similar.

The purpose of applying techniques and methods of the quality management (that are successfully used for environmental management and security management as well) can be systemized into three groups:

- ◊ that all processes in the organization are processes of training and qualification of employees, partners and users;
- ◊ that all employees are qualified to manage processes and
- ◊ that organization is enabled to cooperate with users, cooperate with competitors, cooperate with partners and that organizational parts are enabled to cooperate mutually.

4. QUALITY AND SCIENTIFIC APPROACH

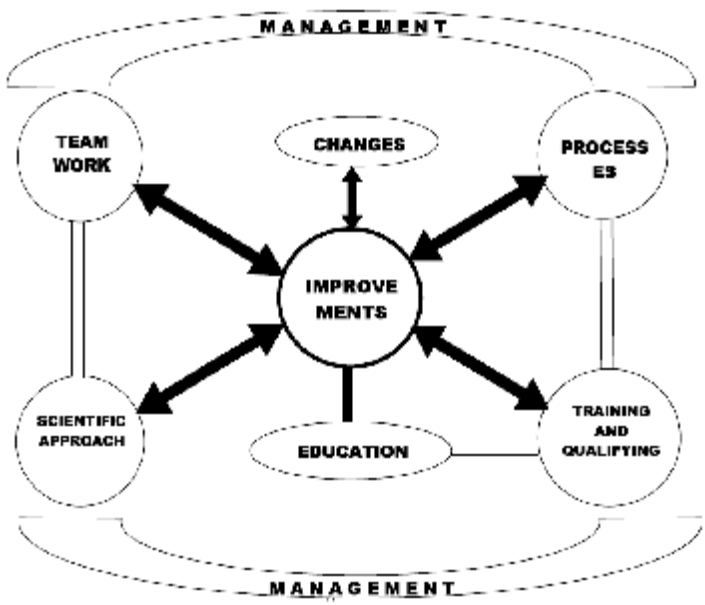
The approach to quality is based on the scientific method and represents an assembly of information ever since F. Bacon, R. Descartes and I. Newton (data accuracy, analysis, synthesis and control) that are now being applied in satisfying wishes, needs and requests of users. Techniques of quality, as one of twenty-four approaches to quality, connect the other twenty-three approaches but these approaches also connect techniques to act consistently on quality improvement.

Techniques of quality are basic grounds for application of scientific methods of quality improvement and new technologies.

Appliance of techniques of quality in all work processes and by all employees provides creation of conditions to elevate the lowest level of knowledge and quality to a higher level

and in that way, to equalize levels of quality of the process. Equalization of the qualities of the process or bringing them to the approximately same level increases the level of connection between functions.

It has been already said that the process of improvement promotes the one who improves the process. However, we cannot stay on so-called self-improvement. In order for the process of improvement to run as „an endless road " where every employee will participate and where every improvement shall encourage new improvements, it is necessary to develop a spiral of the progress: training – improvement - training – science – improvement – science – learning. So as to start this spiral, we should answer the following question: is it possible to advance and improve the society as a whole, and processes both simple and complex without a help of knowledge and scientific methods. If the answer is „it is possible" then we have „sterile" science at stake, and improvements come „with the end". If the answer is „it is not possible without a science" then we should look for the ways of connecting of those employees that are „owners" of the processes and those employees at the institutes and faculties that deal with these processes from the scientific aspect or who deal with methods of diagnostics, measurement, analysis and improvements. These two groups are partners and according to the principle of QMS about partner relations, their cooperation is mutually beneficial.



Improvement and mutual benefits are key words that connect team members to work devotedly and continually on improvements. Work on improvement turns the knowledge of a team (expert and scientific knowledge) into the value. It is efficient – significant knowledge that is also continually renewed, expanded, innovated and actualized.

Members of the team from institutes and faculties bring scientific information, comparative world analyses and scientific methods and tools, while members of the team who are „owners" of the process present the best source of ideas for the improvement and with their good experience they are the best choice to implement the improvement.

The process of improvement through the teamwork of the „owner" of the process and scientists can sustain if it is combined with training and qualification. The other factor that has influence on maintenance of the teamwork system for improvement is massiveness. It means that the actions are taken for improvement of every process in organization and at levels of hierarchy. One team that works on the improvement of one process in the

organization of one hundred employed people would have been suppressed very soon. But twenty teams that improve twenty processes would have created the organization that supports knowledge and progresses. That is so called clever organization that supports and develops knowledge.

Improvement team, structured by the „owner“ of the process and expert and scientists from the institutes and faculties, is a virtual team that can be joined by representatives of partners and users. Set of virtual teams can generate a virtual organization, and they are alike biological system connected into networks, firstly by work in teams and on processes, meaning by knowledge, and then (or alongside) by capital.

This consideration owes an answer to the question from the start of this text whether the quality is a scientific discipline. It has been said enough about relation between the improvement as a key category of quality and training and science. But whether the quality improvement has a scientific approach and whether the application of scientific methods features quality as a scientific category.

Theorists of TQM [ ], who define a TQM by twenty-four approaches , have named one group that consists of four approaches a scientific approach. According to these authors, following approaches belong to scientific approaches:

- scientific forecast and scientific prevention;
- scientific design;
- scientific recognition;
- scientific application.

These four scientific approaches ask for a more detailed consideration, but they indicate a systematic and comprehensive approach to quality and application of scientific methods.

5. CONCLUSION

This paper has reduced one very wide area of consideration such as the quality, to basic relations training – science – quality. It practically means, that only a relation between the training and science regarding one of the QMS principles – improvement has been analyzed. Even such a simplified consideration was not easy to highlight form all aspects. Some aspects of the improvement (sociological, psychological, motivational, philosophical, productive, epistemological, technological, legal, economic and others) had to be left out for some other consideration.

This paper has pointed to the intensive relation between the training, science and improvement, being three crucial points of the spiral of success. Initialized improvements based on the training and qualification; supported by a scientific approach, provide improvements as an „endless road“. It signifies that one improvement „gives birth“ to several new improvements. Improvement and teamwork make one additional, but nevertheless necessary relation, without which there cannot be no substantial improvements. And, without improvement there is no survival.

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