

Slavko Arsovski<sup>1)</sup>

Srdan Nikezić<sup>2)</sup>

Srdan Vladetić<sup>3)</sup>

1) Faculty of Engineering,  
University of Kragujevac,  
Serbia

[cqm@kg.ac.rs](mailto:cqm@kg.ac.rs)

2) Faculty of Science,  
University of Kragujevac,  
Serbia

[srdjan\\_nikezic@yahoo.com](mailto:srdjan_nikezic@yahoo.com)

3) Faculty of Law, University  
of Kragujevac, Serbia  
[svladetic@sbb.rs](mailto:svladetic@sbb.rs)

## IMPLEMENTATION OF QUALITY THROUGH LEADERSHIP FUNCTIONS - CASE STUDY: OLD ROMAN AQUEDUCT

**Abstract:** In this paper, the authors chose the specific implementation approach through quality leadership function, using, therefore, a well-known model of quality implementation in modern organizations, setting the hypothesis of its possible application in the construction of water supply in ancient Rome.

**Keywords:** The leading function, quality, implementation phase of the quality, ancient Rome, aqueduct

### 1. INTRODUCTION

Modern business conditions require from the organization to be more effective and to meet the needs and desires of customers or service users. In organization, whose founder is a state or local government, notwithstanding the absence of competition, the organization must develop a vision and an organizational culture that will serve the time, and organizational structure, which has the task of directing individuals to attain the objectives for which the foundation was made. Public companies that want to meet the interests of the citizens have to apply new technologies and new business roles, and then they are facing the following problems:

- a) Time when the changes should be introduced,
- b) The method of starting the changes,
- c) Function of leader as carrier of changes and
- d) What are the expected effects.

Recognizing the need for changes in public companies are gradually moving

away from the autocratic ways of management, with hierarchical procedures of responsibility and improved social interaction and communication systems, to a democratic way of governance in which the leader with his followers creates team as an important segment of quality management model.

Formal structures and systems are replaced with the process of managing using teams.

Approach based on the process, derived from the leadership vision and mission of the company, through analysis critical success factors and move toward the core organizational processes, enables success in achievement of changes.

### 2. PLANNING IMPLEMENTATION OF QUALITY MANAGEMENT

Many public companies, regardless of size or age, are unable to explicitly answer the question-where and when you start with

change. Some of them, for this reason, never, or at least not on time, do not start to certain changes, despite the known reasons for that change is necessary. In theory, this is known as the concept of total quality paralysis (TQP). In order to overcome those leadership functions is necessary to define a clear vision of the future offering quality and decisions where to start with changes. Effective leadership involves effective quality management with a clear understanding of all aspects of it and trust of followers and teams in the organization. This is the basis for the construction and development of the entire structure of the quality management system. The most common carriers of ideas for change and a new concept of application of the quality system in the organization is a leader because he is the most creative part of the organization. Leader by accepting of its mission and vision, in public company, seeks as an imperative to make the necessary changes in the quality as well as on the organization continues to operate in a new, high-quality condition. This is particularly evident in the leaders who by changing the social and political relations come to the new position with experience and knowledge, and the willingness to accept responsibility in the changed circumstances (Nikezić, 2011).

Ignoring mentioned factors leads have difficulties in defining the quality system and its implementation, to the formation of the credibility gap in quality. Intellectual understanding of quality, its essence, the role and importance for the success of the company constitutes the basis for acting of leader (Stefanovic, N., and Stefanovic, Z., 2007). Leadership position it is necessary to translate in commitment, specific plans and actions that need to reach the goals. It is necessary for a leader, to avoid the difficulties and potential conflicts and frustrations define:

- a) Quality management strategy,
- b) The capacity and
- c) Control mechanisms

Followers or leaders, if they work

according to their own plans, that are not strictly defined, discretion and intuition, can hardly expect to achieve optimum results. Nature of the organization dictates the need to coordinate the efforts of leaders and followers and binding to a single organizational structure, as planned expedient reaction to set a leadership vision. Implementation process begins by **defining the quality policy** and the **determination of the characteristics of the organizational structure**, work involvement in quality through effective teamwork.

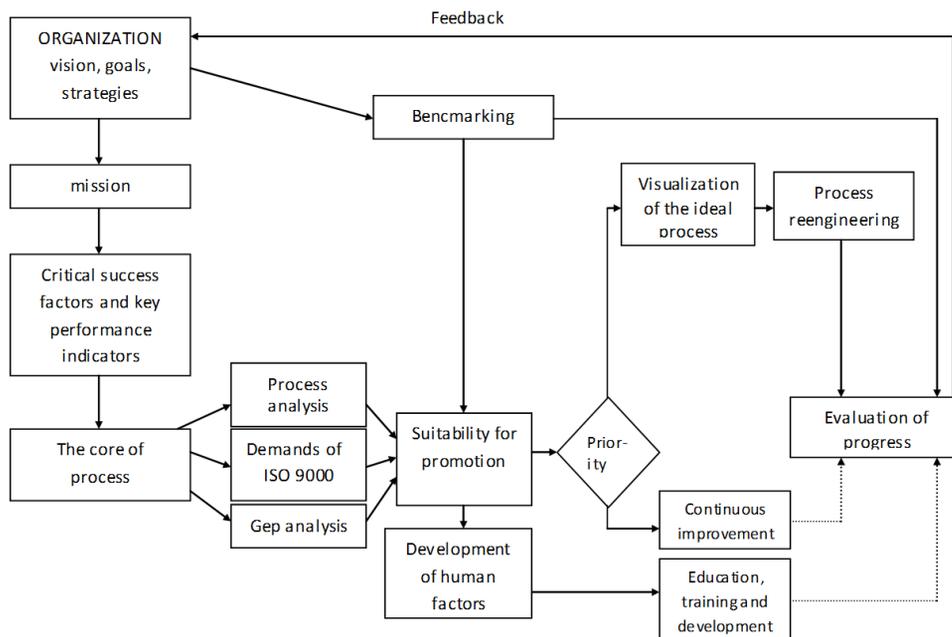
In public companies the biggest influences on the performance have following elements: information about the state of the organization about how it works, including the costs of quality and help to establish the relevant areas in which to act, and information about available resources employees, technology, different abilities and competence (Stefanovic, N., and Stefanovic, Z., 2007).

Transformational leadership assumes establish strong managerial coalitions oriented towards implementation of quality through the project planning since the strategic level, there are projects of different priorities contenders for specific budgetary funds. Because of the complex processes that are based on the vision of the individual, his courage and willingness to learn and openness to his followers, and the values that support, special attention in the existing organizational platform based on which are developed and carried out procedures relating to quality, and the answer to the question of how far came the process of preparing for the implementation of quality and what the state of available resources, is particularly important to dispose of valid estimations of the current state of performance in all organizational areas that are key to the implementation of a quality policy and evaluation program that ensures the continuity of the business improvement. (Arsovski, Z., 2002; Arsovski, S. *et al.*, 2007; Nikezić *et al.*, 2012; Stefanovic, N., and Stefanovic, Z., 2007).

Overall organizational processes, the basic auxiliary and manager, which must be carried out through a leadership function, can be classified into three groups:

- a) Processes that require continuous improvement, given their character, organizational role and significance;
- b) Processes in which should be applied procedure of redefining the problem to solve by approach to a new position with respect to the current situation and the

- achieved performance, and
- c) The process in which a visionary approach should be methodological and applied in a completely new way, since this are crucial changes and changing demands of the organization. In Figure 1, the planning process that consists of several interconnected stages that are necessary to create a planning framework for quality management is shown.



**Figure 1. The process of implementing an effective quality management leadership (Goetsch and Davis, 1994; Goleman, 2004)**

In the process, the first important step is to define your vision of a leader, what the future-where he wants to be, your goals, long and short term, which are landmark in organizing and conducting business activities on the basis of which integrate the efforts of the various levels of the organization, processes and direct role in a systematic and effective way, the way of achieving defined goals and mission as an area of activity in the future. In addition, it is necessary to know the factors that are critical to the success (CSFs) and key performance

indicators (KPIs) in order to obtain answers to whether the organization meets the mission, or moving away from it, from what starting point of the planned expenditure projections, sections and components is.

When an organization led by leader establishes critical success factors (CSFs), intensity, mode of action and consequences, and key success indicators (KPIs), it is necessary to define the core of the process, based on the fact that all processes have the same significance and role in the organization and creating new value and

satisfaction of end users, who purchase products request a particular quality, aesthetic and functional characteristics, and status attributes.

The next part of the process itself estimates "organizational status and organizational effects." Applying the model of excellentes by Baldrige, EFQM model and benchmarking to identify opportunities to improve business operations and quality management systems. On the basis of judgment in determining the processes that should be improved, and which require training of employees through education and training, innovation and new knowledge, abilities and skills. Then identify priority processes, then processes that provide priority to the promotion, and that without delay into the process of review and redesign. After this process comes visualization of the ideal process reengineering and evaluation of progress.

As previously stated, IMS project is complex project with recognized risk aspects. Each subproject has own risk in design and implementation, and is recognized risk of integration. Experience of project teams and management of this project is needed condition, but is not sufficient. It is reason why used team organization with very close connection between consultants and working teams (Figure 2).

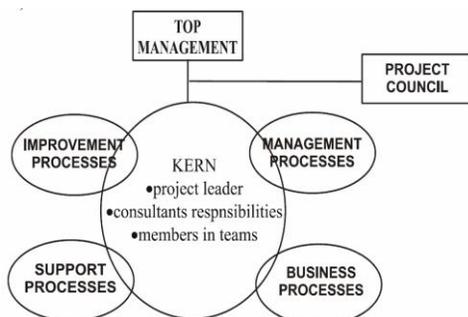


Figure 2. Project organization (Arsovski et al., 2007)

For pilot organization in area of water supply and cleaning wasted water we

recognized goals, processes based on strategic (top down) approach (Table 1).

Table 1. Organizational goals and processes (Arsovski, 2007)

NO	GOAL	PROCESS
1	Increasing of water production	P1: Production and distribution of water
2	High quality of water	P2: Assurance of quality and safety of water
3	Draining and cleaning of wasted water	P3: Collection, draining and Cleaning of wasted water
4	Improvement of support	P4: <ul style="list-style-type: none"> <li>• Maintenance</li> <li>• Transport</li> <li>• Selling</li> <li>• Purchasing ...</li> </ul>
5	Reduction of water loses and electric power and better payment for water consumption	P5: <ul style="list-style-type: none"> <li>• Registration of water joints</li> <li>• Registration of consumers</li> <li>• Energy reductions</li> </ul>
6	Improvement of environment protection	P6: Process of EMS
7	Improvement of safety on work	P7: Process of safety management
8	Accreditation of laboratory	P8: Calibration and Accreditation process

For pilot organization in area of water supply and cleaning wasted water strategic statements are:

**VISION**

West Balkan region lider in supplying consumers with necessary quantity of quality

and properly healthy water and draining and cleaning of wasted water.

**MISSION**

Reliable consumers supplying with necessary quantity of quality and properly healthy water and draining and cleaning wasted water.

**POLICY**

Providing necessary quantity of quality and properly healthy water and draining and distilling wasted water, with respecting requests of interest groups:

- Founders, from aspect of regular supplying of quality and proper health drinking water and protecting health care protection of population and protecting environment by draining and distilling of wasted water,
- Employees, from aspect of occupational health and safety, as economical based payment too,

- Residents, from aspect of getting necessary quantity of quality and properly healthy drinking water and draining wasted water, as protecting environment, with economical acceptable price,
- Business systems, from aspect of regular supplying of quality and properly health drinking water,
- Government, from aspect of harmony development of supplying of necessary quantity of quality and properly health drinking water, protecting environment and health care,
- Management, from aspect of effective and efficous process management of water supplying and draining and distilling wasted water, with respect of limited water, financial and local resources.

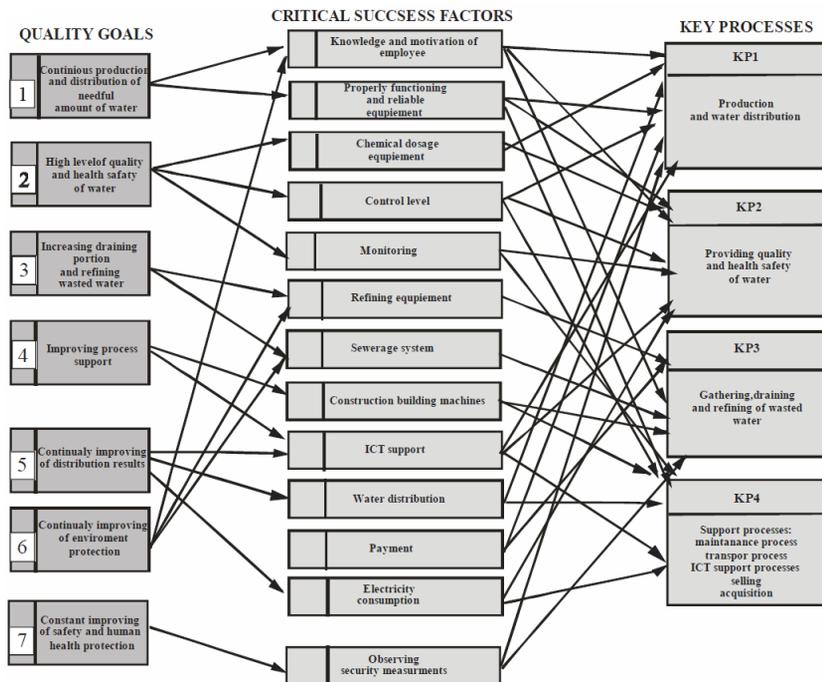


Figure 3. Determination of key processes using strategic top-down approach

The successes of all of these jobs require knowledge of the different elements

and assumptions, organizational or technological nature. Success of implementation of a certain vision in the planning organization excellence approaching performance and high performance, and essentially depends on the commitment of the leaders and followers of the vision, mission, goals and shared values, and the ability of leaders to initiate change, create coalitions for change, reduce resistance to social stakeholder and groups and to build and develop effective teams that are committed to quality policy and general progress.

### 3. SUPPORT, FACTORS AND IMPLEMENTATION PHASE GROUNDS OF QUALITY THROUGH LEADERSHIP IN THE ORGANIZATION

Long-term, implementation is a process of the continuous nature, based on the need to improve the quality management process in order to achieve a competitive advantage and excellence of products and services of the organization. For any organization planning and implementing the deployment of quality with a touch of some differences, derived from the current state of available factors, the nature of organizational processes, capacity of management and staff, the achieved level of development, the nature and quality of products and efficiency and effectiveness. However, the implementation of a process that has all the elements of universality for all business units, such as the framework, principles, concepts, techniques, which can vary and adapt to the specific conditions, nature of the structure factors and processes (Stefanovic, N., and Stefanovic, Z., 2007).

In the process of implementation of quality leader must provide acceptable conditions, corresponding to the base of the Quality Policy and its objectives. Of the relationship view between the leaders of the management that includes the following

(Nikezic et al., 2012):

- 1) Leading management must explicitly express their attitude, commitment to want to bring in quality, to improve operations and performance, and to accept that it is the maintenance and development.
- 2) Complete leading management must participate in the implementation of quality.
- 3) Leading management must sincerely support the leadership vision of the company and its quality and its mission from the perspective of the needs and demands of the market, ie. environment.
- 4) The task of management is to provide organizational requirements, based on guidelines received from leaders in the development of the concept of delegating management and employee participation in decision-making and their teams, and based on the premise that leadership quality over and above all as a common value.

**Leadership behavior towards employees includes the following:**

- 1) An employee in the organization, and other interested stakeholders, must be motivated and prepared for the process and implementation, efficient and engaged in all levels and parts of the structure.
- 2) Employees must be prepared for the process of education and training for the use of certain concepts and techniques that are essential in the process of quality management.
- 3) An employee in the organization need to have full support for the work of leaders and their own attitudes and beliefs, to operative management, supporting leaders support the successful operation and adequately valued employees through rewards and other intangible benefits.

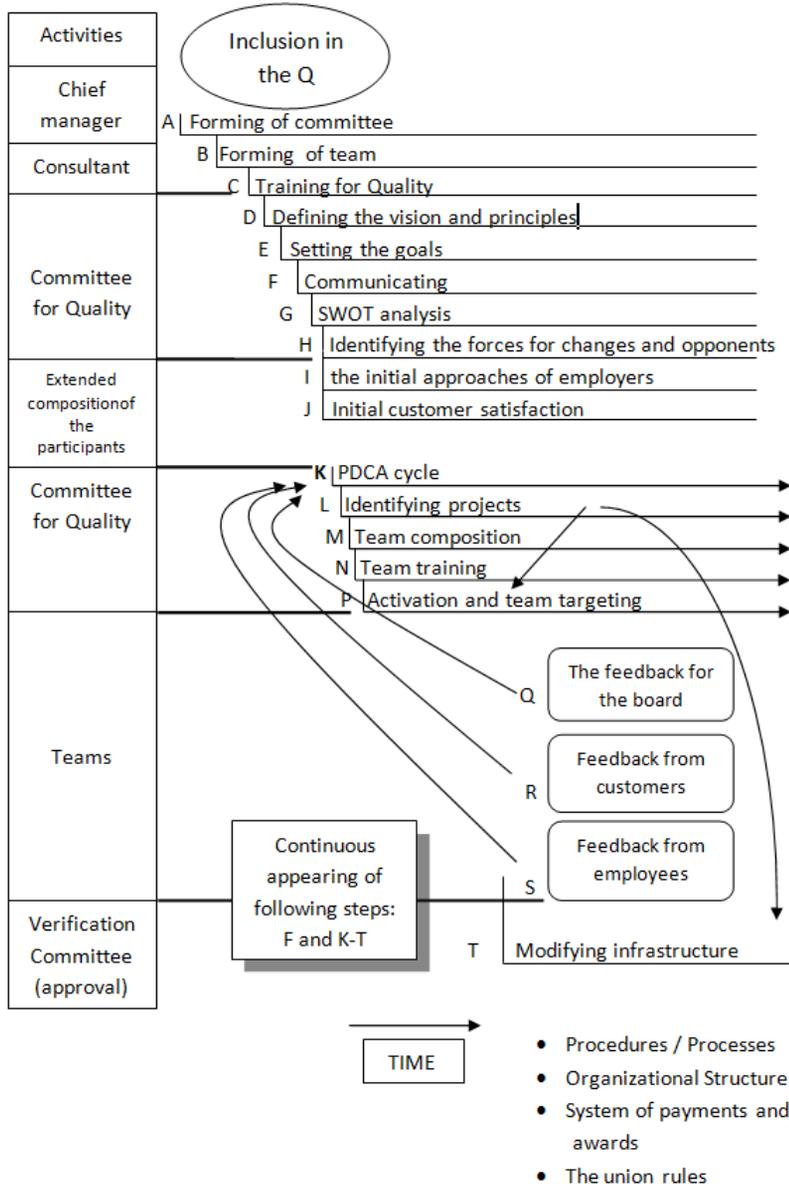
**Leadership behavior towards employees includes the following:**

- 1) The organization structure is open, ready to learn, with an infrastructure that

- successfully connects social actors, groups and organizational levels and parts, with the surrounding.
- 2) Investors are informed about the different aspects of quality of leaders that efforts with improve the management and employees, in the interest of all, especially the end users of products and services, the quality of its implementation and the measures to be taken to the mutual benefit and interest (Stefanovic, N., and Stefanovic, Z., 2007; Goetsch and Davis, 1994; Goleman, 2004; Arsovski, S. and Nikezić, 2012b).
- The success of the implementation of quality changes and affects a number of factors, external and internal, which makes it difficult to objectively leadership position and requires further its engagement at all stages of quality. Influence on the success of the implementation of the following factors:
- a) The foundation of the basics of transformational leadership positions, developed emotional intelligence, creativity and the ability to motivate and mobilize social actors and specialized teams that operate in the organizational structure (Stefanovic, N., and Stefanovic, Z., 2007; Arsovski, S. *et al.*, 2012; Nikezić *et al.*, 2012).
  - b) Willingness to help by internal and external stakeholders.
  - c) Developed sense of urgency for change, enhance quality and problem redefinition of the concept corresponding to the new demands of leadership vision and goals of the organization.
  - d) The high level of team mobilizations for changes.
  - e) Adequate organizational climate and culture: beliefs, values, attitudes, beliefs, and norms, as well as the ability of the company to with existing organizational climate and culture adapt to new needs and requirements, to efficiently and effectively respond to the challenges of competition.
  - f) Benchmarking analysis with competing companies is done to determine the conditions and forecasting measures for improving the process and results.
  - g) Focusing on customers in order to improve the system and quality of products and services that meet their needs and wishes.
  - h) An adequate system of communication channels that provides the exchange and flow of information and ideas from the leaders as the sender to the last employee (Arsovski, S. and Nikezić, 2012b).
  - i) Construction and development of teams and individuals in order through changes, by teamwork achieve the sated leadership objectives (Nikezić, 2012).
  - j) Effective decision-making in all areas of organizational structure: strategic, operational and functional by determining the type of organizational structure, its nature, complexity, formalization, size and number of levels that are different for vertical and horizontal structure (Stefanovic, N., and Stefanovic, Z., 2007; Arsovski, Z. *et al.*, 2012).
- The implementation process of quality includes three key phases: **preparation**, **planning** and **implementation** itself (Pande, 2000). The preparation phase includes several sub-phases: recorded from A to J. The planning phase includes sub-phases recorded from K to N. Implementation phase includes activities recorded from P to T.
- In Figure 4 are given implementation phases of quality: preparation, planning and implementation.
- The first stage is the formation of the committee responsible for policy issues and quality of the company, then the appropriate form teams carry out their training and selection of professional consultants in the field of of quality, development and application of methodologies, tools and techniques as appropriate, in accordance with defined standards and regulations.
- The next phase includes a number of

related activities covered by the Board for the quality, but above all a leader and leading management company, part of staff and specialist functions, such as defining, creating a vision and key principles as a starting point for the implementation of quality, definition of the key goals of the company, communicating vision and goals, with all the social actors and organizational levels of the company, then it makes a

SWOT analysis, which identifies opportunities and threats, strengths and weaknesses of the company and the supporters and opponents of the introduction of quality. Creating adequate Coalition for Change provides the preponderance of forces for change in relation to the power of resistance (Pande, 2000; Stefanovic, N., and Stefanovic, Z., 2007).



**Figure 4. Implementation phases of quality: preparation, planning and implementation.**

In the third phase, expanding the board for the quality and discusses issues related to the assessment of attitudes of employees, since they depend on the efficiency of implementation, the choice of the initial project, according to the strengths and weaknesses of the project, assembling teams from various functional areas of the company, their training, then the coordination and directing teams, round-the board information from customers and employees, and modification of existing infrastructure (Stefanovic, N., and Stefanovic, Z., 2007; Pande, 2000; Arsovski, S., and Nikezic, S., 2012a).

#### **4. SETTING THE PROBLEM AND METHODOLOGICAL APPROACHES**

Analyzing phase of the implementation of quality in modern conditions has been shown that, in practice, certain elements of preparation, planning and implementation can be traced back in ancient Rome, where water quality was one of the conditions for the survival of the city of Rome and the Roman Empire. Using contemporary way to work and the quality of water we tried in Rome, setting specific hypotheses to determine whether there are some interactive components that can connect this distant period of history and current contemporary way of applying the system in water quality. In this study, we started from the following hypothesis:

- H1: Modern approach to the application of the concept quality in water supply can be fully equated with ways of ensuring quality of water in the water system of ancient Rome. The rating for quality in contemporary conditions is 5.
- H2: There are certain processes that will be discussed, which correlate with the common elements in the implementation of water quality in

modern cities with way of water provision in ancient Rome. The rating for quality in contemporary conditions is 5, and the score for the quality of the water supply of Rome defined scale from 1 to 5, with a 2.5 rating minimum level above which provides a correlation between the current approach in the implementation of quality in water distribution systems and the establishment of quality of water supply in ancient Rome.

When setting up a hypothesis and the correlation between the current approach and the establishment of high-quality water supply in ancient Rome, modern approach to the application of the concept of quality in water supply is rated at 5, and the establishment of high-quality water supply in ancient Rome from 1 to 5, depending on the implementation leadership quality management and implementation of quality through the process of preparation, planning and implementation.

Please note that the survey asked for the study of a broad literature, as in previous academic and professional literature this phenomenon is not studied methodological and did not feel attached greater importance. From our point of view it is important to determine whether the existing correlation between real and that you are the cities with over one million people in ancient times were adequate and quality way to provide water for its citizens, because it is not only existentially but also health, social, psychological economic, legal, building and anthropological issues.

Remains of Roman water supply systems are not only an indicator of the Roman building skill, but also an attempt to provide its residents the best hygienic conditions. The entire construction of the system was funded by the state in order to make them accessible to all citizens. Roman needs for drinking water supply long as demand was from nearby wells and springs. But the growth and development of the city

and, population growth and the increasing number of bathrooms caused the water shortage. So the 312th BC, or the 274th BC built the first two underground water - Aqua Appia and Annus Vetus. A century later, they began to build above-ground water (aqueducts), and a row springing Aqua Marcia, tepu Aqua, Aqua Virgo, Aqua Iulia, Aqua Claudia, Aqua Traiana, etc. Already in the first century BC The Romans mastered the process of bringing water (Vladetić, 2012).

The need for a special organ that would take care of a water supply occurred after the construction of the first water supply systems. Information on how we derive, in part, "The Water Supply of Rome" (De Aquis Urbis Romae) of Sextus Julius Frontin, the most famous engineers and water managers (Herschel, 1899). Set during the reign of Nerva (96-98 AD), was given the task to reform water. In his Frontin details the technical specifications for all water utilities that were his starting point to increase the supply and quality of water and is proud of its reform and the fight against fraud, theft and corruption. For Frontin can be said that he was able, conscientious and honest administrator. It was a Roman of the old school, who only sees the beauty in what is intended (Djurant, 1996). The fact that the Romans, in addition to numerous public fountains, water pipes implemented in most of the houses and ground floor of apartment buildings, it is certainly worthy of respect (Vladetić, 2012).

By the end of the first century BC, water management was entrusted to ediles censors and (Baker, 1823) that were dealt with that, within its core competencies (the first is the primary task was to control plebeian cult, and another list of people and property and supervision of morals).

The first permanent water supervisor was Marcus Agrippa (36 - 12 BC), one of the most trusted emperor Augustus. But he was primarily the supervisor of works that he conducted. After a year of his death, by order of August, 11 BC formed a special

service, aquarum cura, whose job was to take care of, supervise and maintain water supply systems, and administrative jurisdictions. At the head office was located curator aquarum - Guardian Plumbing, who was appointed by the emperor from among the senior senator, and he exercised that office for life (Vladetić, 2012; Villems, 1898; Trankvil, 1978).

At the beginning of his work Frontin, and every leader presents his mission and vision as guardian of water supply and says he will diligently and lovingly strive to contribute to the health, safety and comfort of residents of Rome, who must have clean water before they get their Partenone

Below Frontin says: "*For this reason I wrote in this comment what I could gather, and what can contribute to this topic, after I prepared and compiled the collection in accordance with mine experience that has already proven examples from other services (he was in head of Britain Province, 75-78 years BC), so that I can use it in this service*" (Herschel, 1899). Indeed, Frontin first studied in details what it took on an obligation. First, it accurately describes the previously constructed water supplies - their condition, capacity, maintenance, water quality, measurement units, the ratio of released and delivered water and frauds in connection with it. Second, in line with previous offers solutions drawing on their own experiences, but also on past experience and knowledge in the first place Vitruvius (Vitruvius, wrote his famous work "The Ten Books on Architecture" - De Architectura Libri Decem) knowledge of the search, bringing, water quality and leveling. So, Frontin, similar to today's understanding of leadership functions, defining the situation first, and then take the appropriate measures or, set strategic goals and make strategic and operational decisions that enables organizations to adapt to changing conditions (eg, a sudden increase in population and the need for drinking water).

When Frontin came to head of water service under him he had two assistants from

the lower Senator – procurator aquarum et tribunus aquarum. On relation between manager and his assistants Frontin wrote: "The reasonable man's greatest humiliation is when he is performing official duties as instructed by his assistant, and it occurs when a person is incompetent in charge of practical knowledge hides behind his assistants. Knowledge and experience of subordinates is necessary in assisting the supervisor, but it should only be a tool of supervisors" (Herschel, 1899). From the description of the relationship between supervisors and assistants, looms the current relationship between leaders and managers. Frontin, as a supervisor, leader, and his assistant manager, who acts according to his instructions and deal with technical issues.

Assistant addition, the supervisor was surrounded by a number of officials and

lower personal companions (apparatores) such as three state goods (public servi), three architects (later there were seven), then notebook and advertisers (praecones), and if the supervisor goes outside the walls of Rome, and had two armed escorts (lictiores). These persons are dobijalu compensation and were equipped with a desk and other materials for their functions. The compensation was approved exchequer in the form of subsistence allowance for the year, and in such amount as the plumbing supervisors are willing to give, and without having harming themselves (Herschel, 1899; Middleton, 1885). This would mean that a supervisor may require a greater amount to be awarded valuable officers and thus stimulate others to work, but also to reduce some profits.

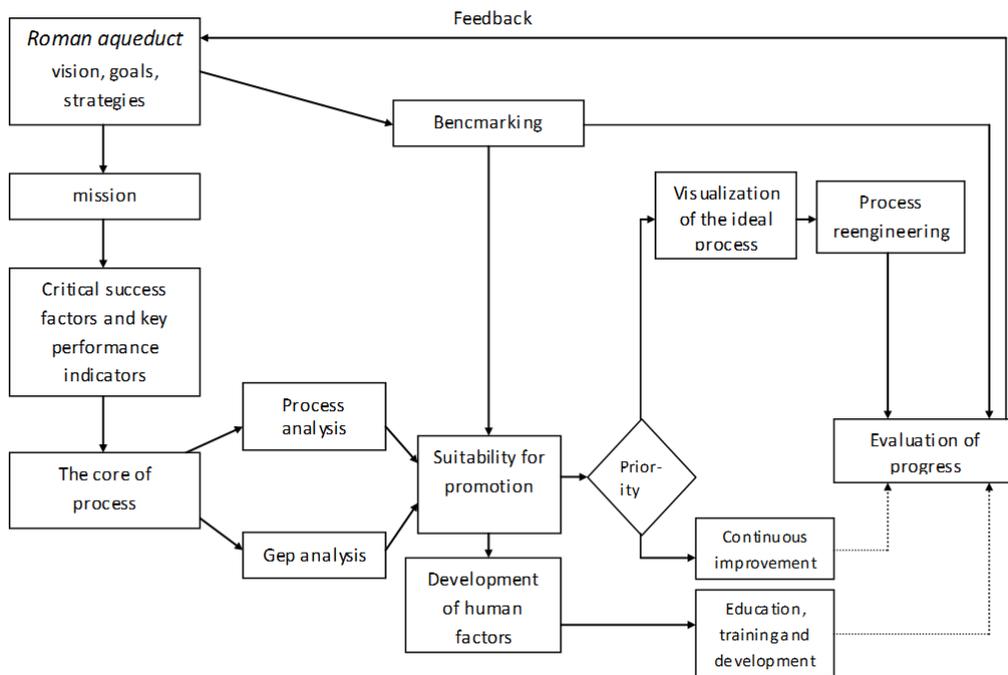


Figure 5. The process of implementation of water quality management leadership in ancient Rome

At the bottom of the organizational structure there were artisans (mostly slaves) who worked on the maintenance of water supply. They were divided into those who

belong to the state and the emperor himself. The first received a salary from the state treasury, and the other was paid by emperor (Herschel, 1899). In each group, there were

teams of different craftsmen: Aquaria or villici who setting up water supply pipes, tank guards (castellarii), work supervisors (circitores), levelers (libratores), workers cobbling - pavers (silicarii) after repair, etc... These workers, in addition to regular maintenance, intervene in emergency situations when water should be carried from a reservoir with a large inventory of parts of the city where the shortage of water. As it often happened that arrogant supervisors work take workers to do private jobs, Frontin decided, as he says, "to impose discipline in the civil service." He ordered the day before a timetable for what everyone should do, and to keep a record of the work that is done.

*Note: in the picture no. 5 for each process is given rating from 1 to 5th In Figure 1 the for implementation process in modern terms as a starting maximum score is taken rating 5 for all processes.*

1. Vision, goals and strategies - secure health, safety and comfort of residents of Rome. **Grade 5**
2. Mission - The drinking water for the inhabitants of Rome. **Grade 5**
3. Critical success factors and key indicators of performances - the capacity of water supply, maintenance, water quality, measurement units, the ratio of released and delivered water and fraud related to the. **Grade 3**
4. The core of the process - the availability of drinkable water to all residents of the city of Rome. **Grade 3**
5. Process analysis - identify and promote water activities, detailing the previously constructed water supply systems, and offers solutions relying on their own and previous experience in building water supply systems. **Grade 3**
6. ISO 9000 - implementation of some elements of ISO standards. **Grade 2**
7. Gap analysis - Roman conservatism, tradition and pagan beliefs. **Grade 1**
8. Benchmarking - incomparable with the current water supply systems. **Grade 1**
9. Benefits for improvement – previous experience in the management of water

supply for a period of 130 years and the relative proximity of the water source.

**Grade 3**

10. Development of human factors - education of senior and junior clerks on the basis of expertise and experience, motivation through enthusiasm and personal example, reward and punishment, and moral support.

**Grade 3**

11. Priority - water supply as an open structure is subject to positive changes in the environment (technical knowledge of the ancient Greeks), Roman architectural knowledge (for example, work on the architecture of Vitruvius), approval of water for personal use (with the permission of the emperor). **Grade 3**

12. Visualization of ideal process - healthy water, continuous supply, quality of materials and maximum availability of water. **Grade 3**

13. Continuous improvement - creating a climate and culture for new learning and knowledge through the definition of new values, beliefs, attitudes and norms among the citizens of Rome on the importance of water. **Grade 3**

14. Education, training and development - leadership training of supervisors (Frontin): assistants, lower clerks and personal escort (notaries, architects, public officials, and advertisers). **Grade 2**

15. Process Reengineering - change in metrics measures for couplings, which are used to measure water, determination of their origin, size, and the existence of disparity in the proportions and capacity. **Grade 5**

16. Measuring progress - development of teams during the implementation of water supply system, the effective prevention of stealing and abuse of water, personal development of individuals through practical work and supervision minimizes errors in the construction of water supply and speeds up the construction or seeking expansion of work, and lay consultation if necessary.

**Grade 3**

*Conclusion: On the basis of the implementation process of water quality*

management leadership in ancient Rome, was obtained for all three processes, the average score, which indicates the existence of a correlation between the effective

leadership of the process of implementation of water quality management in modern conditions and water quality management in ancient Rome, which proves hypothesis H2.

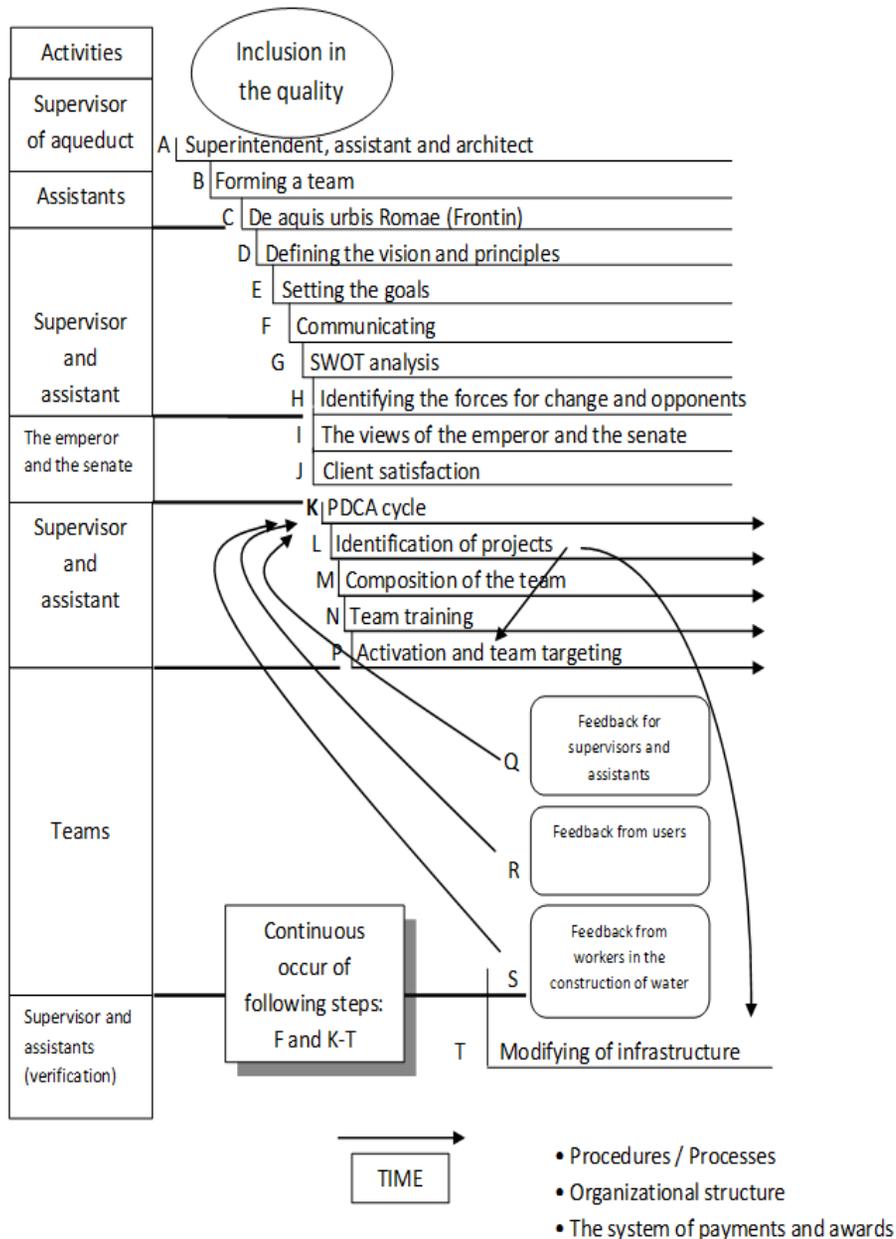


Figure 6. Implementation phases of quality: preparation, planning and implementation in ancient Rome (water)

*Note: in the figure no. 6 for each phase of implementation of the quality is given grade from 1 to 5<sup>th</sup>. In figure 4 for implementation phase in modern terms as a starting maximum score is taken grade 5 for all five phases.*

A - in ancient Rome in preparation for the construction of water supply was not a classic quality board, but that role had Frontin (supervisor) and his assistants.

**Grade 2**

B – supervisor and assistants form a team which, in addition to their primary duties (eg plumber were supposed to take care not to mix water of different qualities) monitors the quality. **Grade 3**

C – supervisor Frontin in his book "The Water Supply of Rome" transmits the experience gained from the practice of their associates and successors as a specific type of training. **Grade 4**

D – supervisor vision is to provide clean and healthy water to all residents of Rome **Grade 5**

E - providing health, safety and comfort for all residents of the city. **Grade 5**

F – communication process is provided with feedback between supervisor, as a leaders, and his associates, on the one hand, and supervisor with the Senate and the emperor, on the other hand. **Grade 4**

G – SWOT analysis was not performed because the plumbing in Rome belonged to the state. **Grade 1**

H – the emperor, the senate and the supervisor were the promoters of the construction of waterworks in Rome. **Grade 5**

I – Emperor and the Senate had crucial role in the construction and use of water supply system, a supervisor took care of the water quality. **Grade 4**

J – during the Frontin supervision in Rome there was a nine water supply system. **Grade 3**

K – PDCA cycle was applied in the construction of the Roman aqueduct through

a process of continuous planning, construction works, control and completion.

**Grade 3**

L – identification of the project is carried out in consultation of experts and citizens' needs, and for this process supervisor is responsible. **Grade 3**

M – wardens team included: assistants, lower clerks and personal companions (apperatores) such as civil servants (servi publici), architects, notaries and advertisers (praecones), and if necessary armed escorts (lictors). And apart from them craftsmen, divided into sub-teams: plumbing installers (aquarii or villici), tank guards (castellarii), work supervisors (circitores), levelers (libratores), workers cobbling - pavers (silicarii). **Grade 4**

N – transfer of acquired knowledges, experience and skills, for which superintendent assistants were responsible.

**Grade 4**

P – activation and direction of contractor for construction of water supply is done through the process of continuous quality control and finalization. **Grade 3**

Z - Procedures, processes, organizational structure, pay and recognition are defined by the essential need to maintain water supply system quality of life in Rome, and the dimensions and performance were determined in short and long-term periods for each component. **Grade 2**

*Conclusion: Based on the individual stages of implementation of water quality management leadership in ancient Rome, was obtained for all phases of the average score 3.43 indicate that there is a correlation between the stage of implementation of water quality management leadership in contemporary management and quality of water in ancient Rome.*

## 5. RESULTS AND DISCUSSION

On the basis of the evaluation of process and implementation phase of water supply system quality management leadership in ancient Rome, starting from contemporary

way of quality management in Figures 5 and 6 shows the completed evaluation processes and phases and based on that can be done the following results:

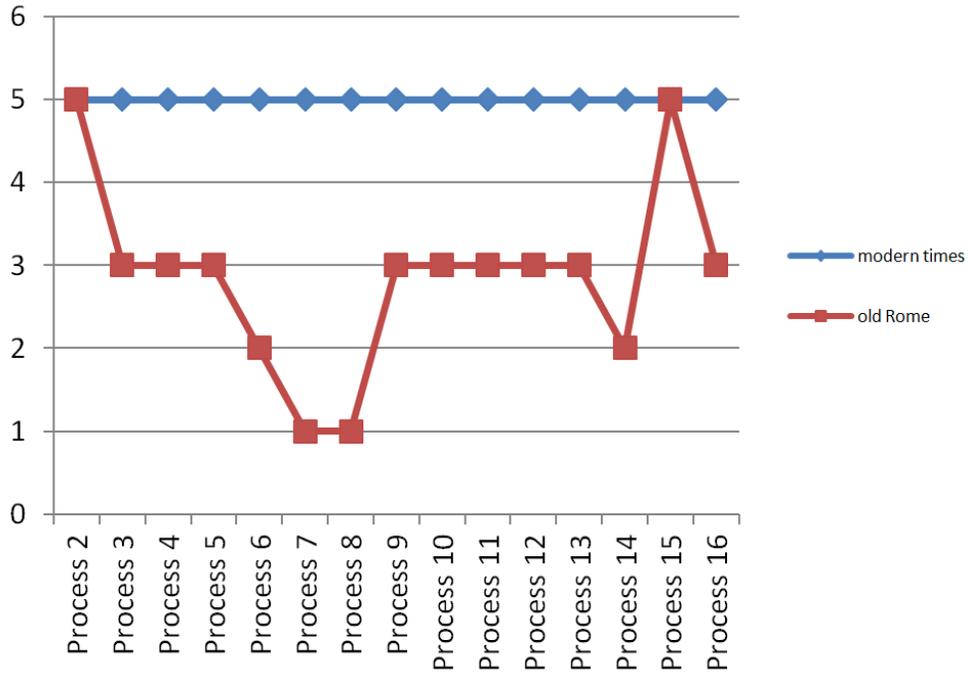


Figure 7. Assessment of the implementation process of leadership quality management in ancient Rome

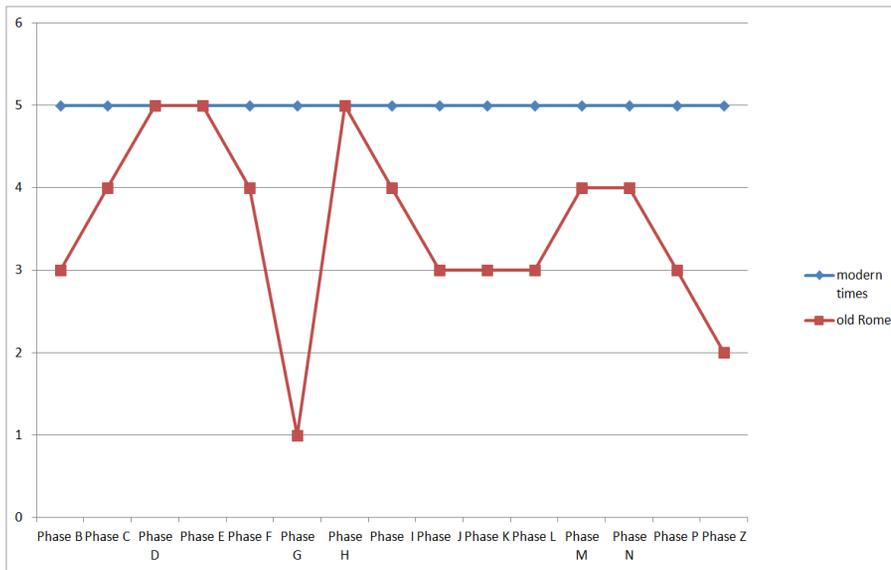


Figure 8. Assessment of phase of the implementation of leadership quality management in

### *ancient Rome*

**a)** When evaluating the implementation process of quality management leadership in ancient Rome, processes under numbers 1, 2 and 15 were given a maximum rating of 5, or, as with the implementation of modern management of water supply of quality leadership vision (ensuring health, safety and comfort of residents of Rome), mission (drinking water for the inhabitants of Rome) and the re-engineering process (change coupling metrics to measure water, determine their origin, size, and the existence of disparity in the proportions and capacity) fully meet the criteria to be applied in modern conditions.

**b)** The implementation process at number 7 and 8 are given the minimum grade 1, because the gap analysis (Roman conservatism, tradition and pagan beliefs) and benchmarking (incomparable with the current water supply systems) have not been applied in the implementation of quality management leadership.

**c)** In Figure 7, the blue line defines the implementation process in modern conditions are starting to excellent. Red line follows the course of the implementation process in ancient Rome, with all the disadvantages caused by the then technical-technological, social, political, and social problems of the time.

**d)** In the evaluation phase of the implementation of quality management leadership in ancient Rome can be seen that the phase D, E and H, with a maximum rated grade 5. We can conclude that the vision of Frontin allow supervisors to ensure clean and safe water to all residents of Rome, to ensure their health, safety and comfort, and that the emperor, the senate and the supervisor were promoters of construction water at Rome, regardless of slaveholders social order.

**e)** Implementation leadership quality management phase H was evaluated with a minimum score of 1, because a SWOT analysis was not performed because the

plumbing in Rome belonged to the state, and had no competitive alternative.

**f)** In Figure 8, the blue line, defines the quality of the implementation phase in the modern economy, and employers of their excellence as core characteristics. The red line is following quality of the implementation phase in ancient Rome.

Technology first waterworks in ancient Rome was studied in detail, in order to ensure maximum efficiency in the transport of water, because the prices of the first waterworks were enormous because of their length. Drop of water was carefully studied and the length of water determined by the fact that the rise could not exceed a certain slope. Tubes, which maintain high pressure and siphons, were used. Vitruvius believed that the over ground water supply (aqueducts) are the best possible solution to the problem of height differences. The filters are used to remove impurities and improve water quality.

Vitruvius gives the structure of the social system and its regulation, and the impact of the configuration of urban space with reference to the obligation of payment of water. Annual fees were paid for the bathroom. There were two other reservoirs and has been providing water to private homes, but with a commitment to never come to a lack of water for ordinary people. Private citizens with their private water systems have not been able to use the water if it was not for ordinary people. The reason for creating more reservoirs with three systems is that private citizens are required to pay annual maintenance overhead plumbing.

As for the roads were living information, the state of water supply network was very important, was carried out continuous monitoring system in order to avoid the loss of water in some areas of the city. There are special service supervisor who intervened in the case of certain failures.

All of these are described from the standpoint of the then-available sources of Rome, some information was hard to get. It is important to note that today's distance from us is really hard to say how effective were the regulations and rules, and how they are applied so really like writing Frontin and Vitruvio. That is why our task and the hypothesis were very awkward.

All Archeological excavations show only one side of a written document generalizes the other side, noting that the books on the water supply and construction of water supply systems reported seen members of the ruling class, with all its positive and negative connotations. State relations, and economic power of citizens, were based on the slave-owning system. Hierarchical Roman society was governed by internal interpersonal relationships. These relations were moving channels that were clearly defined, although they were not legally regulated. The system also included the application of building regulations, but the turbulent eye of the ruling class (Juran, 1995).

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## 6. CONCLUSIONS

Based on the application of the proposed evaluation process phase and the implementation of quality management leadership, the hypothesis H2 is confirmed (processes and implementation phases of water and quality management leadership in ancient Rome correlate with common elements in the implementation of water quality in contemporary cities) as the average score for the three processes 1-5 scale, and the average score for stage was 3.43 on the same scale, a score 2.5 was taken as the minimum level above which ensures the existence of correlation.

Hypothesis H1 was not confirmed because modern approach to the application of the concept quality in water supply can not be fully equated with ways of ensuring quality of water in the water system of ancient Rome.

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