



University POLITEHNICA of Bucharest
Doctoral School of Industrial Engineering and Robotics

Alexandra-Ioana I. MARIAN

Ph.D. THESIS SUMMARY

**DEVELOPMENTS AND CONTRIBUTIONS TO THE IMPLEMENTATION
OF AN INTEGRATED QUALITY RISK MANAGEMENT SYSTEM IN THE
PROCUREMENT OF INDUSTRIAL EQUIPMENT**

**DEZVOLTĂRI ȘI CONTRIBUȚII PRIVIND IMPLEMENTAREA
SISTEMULUI DE MANAGEMENT INTEGRAT CALITATE-RISC ÎN
DOMENIUL ACHIZIȚIILOR DE ECHIPAMENTE INDUSTRIALE**

Ph.D. Coordinator:

Prof.em.PhD.Eng.,PhD.Ec. Constantin MILITARU

Ph.D. COMMITTEE

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CONTENTS	Pag. Thesis	Pag. Summary
List of abbreviations.....	<i>i</i>	4
Acknowledgement.....	<i>ii</i>	5
Introduction.....	<i>iii</i>	6
Chapter 1		
LATEST RESEARCH ON QUALITY RISK MANAGEMENT IN THE PROCUREMENT OF INDUSTRIAL EQUIPMENT	1	8
1.1 General aspects of quality risk management.....	1	8
1.1.1 Theoretical considerations regarding quality management.....	1	8
1.1.2 Theoretical considerations related to <i>risk</i> and <i>risk management</i>	13	11
1.2 Aspects related to procurement in a quality-risk management approach	21	12
1.2.1 Considerations regarding the evolution of procurement legislation and regulations, at the European level and in Romania.....	21	12
1.2.2 The new legislative package and the principles of public procurement.....	25	13
1.2.3 Aspects related to organizing a procedure for the award of the public procurement contracts, types of procedures, the stages of the procurement process, and the risks within each stage.....	27	14
1.3 Considerations on implementing internal control standards in public institutions.....	35	15
1.4 Aspects regarding the procurement from ISO 9001: 2015 and the ISO 31000 family of standards viewpoint.....	40	15
1.4.1 Establishing the quality assurance requirements in the procurement and transposing them into contractual terms.....	40	15
1.4.2 Public procurement key performance indicators. Relevant aspects regarding risk management in procurement.....	44	16
1.4.3 The opportunity to implement an integrated quality management system in procurement. Preliminary conclusions and research objectives.....	46	16
Chapter 2		
AIMS AND OBJECTIVES.....	48	17
2.1 Current research trends in risk assesement and integrated quality risk management in the public procurement system.....	48	17
2.2 Delimitations of the study.....	50	17
2.3 Research aims and objectives.....	51	17
Chapter 3		
THEORETICAL DEVELOPMENTS AND CONTRIBUTIONS REGARDING QUALITY AND RISK MANAGEMENT IN PUBLIC PROCUREMENT.....	53	18
3.1 Considerations regarding the identification of risks in public procurement.....	53	18
3.1.1 Studies and theoretical contributions on identifying the main internal and external factors that may influence the procurement process.....	53	18
3.1.2 Managing ethical risks in the award of public contracts.....	55	18
3.2 Theoretical contributions to improving procurement planning in a risk-based approach.....	57	19
3.2.1 Qualitative risk analysis using <i>SWIFT technique</i> and <i>scenario analysis</i> . Development of <i>Gantt charts</i> for optimizing the procedure timeline.....	57	19
3.2.2 Quantitative analysis of risks in procurement using tree diagrams.....	58	19

<i>Develop. and contrib. to the impl. of an integr. Quality-Risk Manag. system in the procurement of industr. equip.</i>		
	<i>Thesis</i>	<i>Summary</i>
3.2.3 Regrouping the main categories of risks specific to the procurement planning stages by developing questionnaires with control points.....	65	21
3.3 Study on carrying out procurement procedures in a risk-based approach.....	66	21
3.3.1 Developments regarding the use of <i>root cause analyses</i> for determining the main factors that can influence the procedure outcome.....	66	21
3.3.2 Examining activity journals to monitor vulnerable situations.....	69	22
3.4 Optimizing the procurement process by redesigning the timeline and integrating risk management at the procedural stages.....	71	23
3.4.1 Design, implementation and improvement of the integrated quality risk management system in a public institution with procurement competencies for industrial equipment.....	71	23
3.4.2 Developments and contributions to the development of a framework model for the award of a public procurement contract for an industrial equipment.....	84	27
Chapter 4		
APPLICATIVE CONTRIBUTIONS AND CASE STUDIES ON INTEGRATED QUALITY-RISK MANAGEMENT IN THE PROCUREMENT OF INDUSTRIAL EQUIPMENT.....	102	31
4.1 Practical research and a simulation study on managing public procurement contracts and assessing risks in the procurement of industrial equipment.....	102	31
4.1.1 Establishing the general procurement framework and setting performance objectives.....	102	31
4.1.2 Assessment of the risks associated with the procurement process and the object of the contract.....	114	34
4.1.3 Contract management and contract reporting activities.....	114	35
4.1.4 Organizing and carrying out the procedure.....	115	35
4.1.5 Analysis and evaluation of public procurement results.....	117	36
4.2 Contributions on improving the procurement process by developing an IT application for resource management and procurement support	124	37
4.2.1 RSAP platform interface and main functions.....	124	37
4.2.2 Contributions regarding the application of the <i>Brainstorming technique</i> for risk assessment and for the procurement performance analysis.....	128	40
4.2.3 Contributions on the application of the <i>Delphi technique</i> for risk assessment and for the procurement performance analysis.....	129	40
4.3 Study on approaching procurement as a project and using Monte Carlo method to simulate the Procurement Timeline under risk and uncertainty.....	130	40
4.4 The development of the procurement performance evaluation function and the level of achievement of objectives based on the satisfaction evaluation questionnaires	137	42
4.5 Recommendations to increase the performance of the public procurement process by implementing an integrated quality risk management system.....	146	44
Chapter 5		
GENERAL CONCLUSIONS. PARTICULAR CONTRIBUTIONS. FUTURE DEVELOPMENTS AND APPLICATION OF RESEARCH RESULTS.....	148	46
5.1 General conclusions.....	148	46
5.2 Particular contributions.....	149	46
5.3 Development perspectives.....	150	47
5.4 A synopsis of research results.....	151	48
BIBLIOGRAFY.....	152	49
APPENDICES.....	161	-

LIST OF ABBREVIATIONS

ANAF	<i>National Agency for Fiscal Administration</i>
ANAP	<i>National Agency for Public Procurement</i>
AQAP	<i>Allied Quality Assurance Publication</i>
ASRO	<i>Romanian Standards Association</i>
CE	<i>EC - European Commission</i>
CEE	<i>EEC - European Economic Community</i>
CIV	<i>Vehicle Identification Card</i>
CNCIR	<i>National Company for the Control of Boilers, Lifting Installations and Pressure Vessels</i>
CNSC	<i>National Council for Solving Complaints</i>
CPV	<i>Common Procurement Vocabulary</i>
DCIMRI	<i>Directorate of Internal Managerial Control and Interinstitutional Relations</i>
DUAE	<i>European Single Procurement Document</i>
ERP	<i>Entreprise Resource Planning</i>
FMEA	<i>Failure Mode and Effects Analysis</i>
HACCP	<i>Hazard Analysis Critical Control Point</i>
HAZOP	<i>HAZard and OPerability study</i>
ISCIR	<i>National Authority for Control and Approval of Boilers Pressure Vessels and Hoisting Equipment</i>
ISO	<i>International Organization for Standardization</i>
OSGG	<i>Order of the General Secretariat of the Government</i>
OUG	<i>Government Emergency Ordinance</i>
SWIFT	<i>Structured technique „What if”</i>
PAAP	<i>Annual public procurement programme</i>
PEST	<i>Political, Economic, Socio-cultural and Technological</i>
RSAP	<i>Resources and Support for Public Procurement</i>
SAAP	<i>Annual Public Procurement Strategy</i>
SICAP	<i>Collaborative Information System for Public Procurement (replaces SEAP - Electronic Public Procurement System))</i>
SMC	<i>Quality Management System</i>
STEEPLE	<i>Social, Technological, Economic, Environmental, Political, Legal, Ethical</i>
STANAG	<i>Standardization Agreement</i>
SWOT	<i>Strengths, Weaknesses, Opportunities and Threats</i>
TVA	<i>VAT</i>

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Due to over eight years of experience in a public institution, I possess a profound comprehension of the importance of quality and risk, thus realizing that performance in public procurement means more than spending funds or meeting specific deadlines. This involves transposing the beneficiary's requirements into technical specifications, requiring rigorous planning of the procurement process, taking into account the pre-established objectives, available resources, and risks that may affect the schedule or the outcome of the contract. It also involves taking specific measures to prevent conflicts of interest or violations of the code of conduct. In public procurement, the quality of the products translates into compliance with the Requirements Package and the technical proposal approved by the contracting authority.

In this context, designing and implementing an integrated quality-risk management system accustomed to the specifics of the institution and which complies with current standards confirms a quality-focused management strategy. Also, proactive risk management allows the optimization of the decision-making process.

* * * * *

The research I performed during Ph.D. studies would not have been completed without the support of many co-workers and colleagues or the support of family and dear friends. I believe I now have the opportunity to express my gratitude for all their support.

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INTRODUCTION

The solution proposed in the thesis consists in **implementing an integrated quality risk management system** based on the requirements of ISO 9000 and ISO 31000 series, but expressly **considering the provisions of public procurement legislation** and in compliance with the Internal control in public sector organizations.

The paper is structured in five chapters, distributed over 161 pages, and contains 72 figures, 76 tables, 10 mathematical expressions, 228 bibliographic references and 9 Appendices with 9 pages, as follows:

Chapter 1 - "Latest research on quality risk management in the procurement of industrial equipment" is structured as follows:

Subchapter 1.1 *General aspects of quality risk management* presents aspects regarding the conceptual evolution of quality and quality management, quality characteristics of products and life cycle of industrial equipment, indicators of economic efficiency, and some theoretical considerations regarding risk and risk management.

Subchapter 1.2 *Aspects related to procurement in a quality-risk management approach* presents the evolution of public procurement regulations, the principles of public procurement, considerations regarding the planning phase and the types of procedures, the phases of the procurement process, and the associated risks.

Subchapter 1.3 *Considerations on implementing internal control standards in public institutions* reviews the evolution of the legislative system and the main requirements of the Internal Control System and standard 8 - Risk management.

Subchapter 1.4 *Aspects regarding the procurement from ISO 9001: 2015 and the ISO 31000 family of standards viewpoint* provide suggestions regarding the transposal in contractual terms of the primary quality assurance requirements. It also presents relevant aspects regarding risk management in procurement.

The chapter is 47 pages long and contains 22 figures, 19 tables, 3 mathematical expressions, and 4 appendices. It concludes with the elaboration of preliminary conclusions associated with the opportunity of implementing an integrated quality-risk management system in procurement.

Chapter 2 - "Aims and objectives" provides an analysis of current trends in research on quality risk management in procurement (including a tabular representation), limits of the research area, and the theoretical and applicative objectives of the study.

Chapter 3 - "Theoretical developments and contributions regarding quality and risk management in public procurement" contains 14 figures, 14 tables, 5 mathematical expressions, and 4 appendices and covers a total of 49 pages. It is structured in four subchapters, as follows:

Subchapter 3.1 *Considerations regarding the identification of risks in public procurement* includes several studies and theoretical contributions on identifying internal and external factors that may influence the procurement process, ethical problems in competitive bidding, and examples of fraudulent misrepresentation in public institutions.

Subchapter 3.2 *Theoretical contributions to improving procurement planning in a risk-based approach* sets out aspects of risk analysis and proposes a method of improving procurement planning by classifying significant risks.

Subchapter 3.3 *Study on carrying out procurement procedures in a risk-based approach* practically highlights the results of root cause analysis and activity records for monitoring vulnerable situations, using the lessons learned method.

Subchapter 3.4 *Optimizing the procurement process by redesigning the timeline and integrating risk management at the procedural stages* presents a framework model for implementing a quality-risk management system in a public institution that purchases industrial equipment.

Chapter 4 - "Applicative contributions and case studies on integrated quality-risk management in the procurement of industrial equipment" includes 36 figures, 42 tables, 2 expressions, 1 Appendix and runs over a total of 46 pages. It is structured as follows:

Subchapter 4.1 *Practical research and a simulation study on managing public procurement contracts and assessing risks in the procurement of industrial equipment* simulate the awarding process in a quality-based approach and taking into account the risk.

Subchapter 4.2 *Contributions on improving the procurement process by developing an IT application for resource management and procurement support* presents the interface of an IT application with many functions in public procurement planning.

Subchapter 4.3 *Study on approaching procurement as a project and using Monte Carlo method to simulate the Procurement Timeline under risk and uncertainty* supports the decision-making process by providing a reliable timeframe using simulation software.

Subchapter 4.4 *The development of the procurement performance evaluation function and the level of achievement of objectives based on the satisfaction evaluation questionnaires* proposes a questionnaire template used by procurement specialists to perform an objective evaluation of the performance of a specific purchase.

Subchapter 4.5 *Recommendations to increase the performance of the public procurement process by implementing an integrated quality risk management system* provides an overview of the instruments proposed by the author, as well as a quantifiable estimate of results based on performance indicators.

Chapter 5 - „General conclusions. Particular contributions. Future developments and application of research results” presents the conclusions of the research, original contribution to knowledge, directions for future research, as well as a summary of how the results are disseminated.

The thesis finishes with the 228 bibliographic references resulting from the documentary study carried out during the elaboration and completion of the paper.

Keywords

Chapter 1: quality management, industrial equipment, supply chain, risk management, public procurement, Internal Control, quality assurance

Chapter 2: current research trends, quality-risk management system, value for money

Chapter 3: ethical risks, SWIFT technique, scenario analysis, Gant charts, procedure timeline, tree diagrams, questionnaires, root-cause analysis, activity journals, integrated quality-risk management approach

Chapter 4: performance indicators, contract management, IT application for resource management and procurement support, brainsorming and Delphi technique, Monte Carlo simulation, procurement performance evaluation

Chapter 5: conclusions, particular contributions, simulated applied research

CHAPTER 1

LATEST RESEARCH ON QUALITY RISK MANAGEMENT IN THE PROCUREMENT OF INDUSTRIAL EQUIPMENT

1.1 GENERAL ASPECTS OF QUALITY RISK MANAGEMENT

1.1.1 Theoretical considerations regarding quality management

A. Aspects regarding the conceptual evolution of quality and quality management

Quality has always been a concern for world-renowned philosophers and thinkers, and gradually the quality experts, practitioners, and managers of successful companies have recognized its importance, and all their efforts will be directed towards ensuring a high level of quality products and services.

The term "**quality**" has its origins in Ancient Rome in the 45s BC, when the philosopher Cicero first used the word *qualitas* with the meaning of *attribute, way of being, property*.

"Quality is not an act, it is a habit"

Aristotle [217]

In 1924, **Dr. Walter Shewhart** introduced the concept of quality control (Figure 1.1.), shifting the focus from reactive management - taking action after inspection, to proactive management, as part of the entire production process. Applying statistical theories in quality management, he developed the first statistical control graphs and demonstrated that by eliminating variations within the processes, optimal, standardized results are obtained.

At the same time, W. Shewhart studied the idea of a cycle of continuous quality improvement, represented in the form: Plan-Do-Study-Act [28], [99], [122], [123].

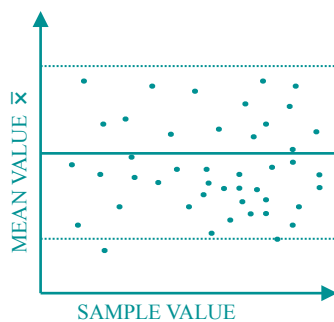


Fig. 1.1 Quality control chart
(author adaptation after [123])

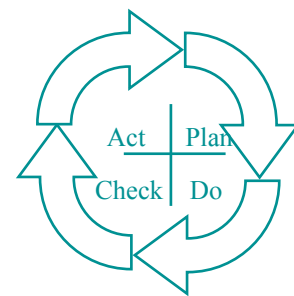


Fig. 1.2 PDCA Cycle
(author adaptation after [17], [95])

J.M. Juran introduces the notion of **quality management**. In addition to implementing *the Pareto principle*, his work "*Juran's Quality Control Handbook*," *the Six Sigma* principles, and the *Quality Trilogy* offered him the status of a specialist who laid the foundations of modern quality management [17], [28], [56]-[58], [95], [99], [110], [126].

The most significant event in the evolution of quality was the development of **ISO 9000 standards**. They have their origins in the United Kingdom in the 1950s, a time when the supply of the Ministry of Defense was endangered by the unreliability of the equipment purchased [17], [99].

Romania has adopted **SR EN ISO 9001:2015 Quality Management Systems Requirements**. Quality management system documentation is still in usage.

However, new concepts appear, such as organizational context, stakeholders, leadership, environment for the operation of processes, documented information, control of production and service provision, actions to address risks and opportunities. The components of an SMC are represented in figure 1.3. [25], [86], [116], [135], [163] - [165], [188].

Quality – degree to which a set of inherent characteristics of an object fulfils requirements
ISO 9000:2015 [164]

Quality tools and techniques have significantly evolved over the last few decades. They include but are not limited to: cause analysis tools (cause and effect diagrams, Pareto charts, scatter charts), evaluation methods, and decision-making techniques (decision matrix). At the same time, they include: data collection and analysis tools (graphs, control charts, histograms, sample analysis), affinity diagram, comparative analysis, brainstorming, project management tools (Gantt chart and Plan-Do-Check-Act plan), but also other process control tools (relationship diagram, tree diagram, arrow diagram) [1], [17], [26], [28], [37], [40], [43], [54], [100], [113].

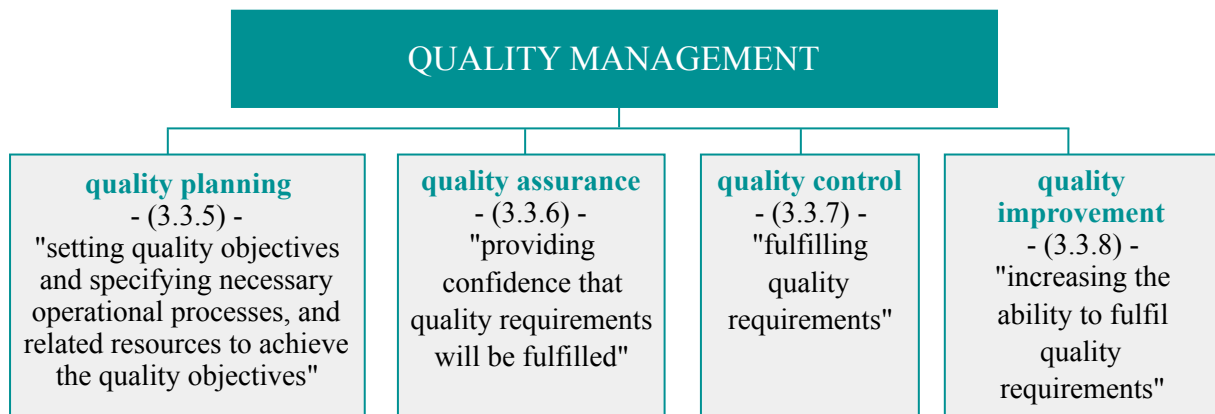


Fig. 1.3 Components of a Quality Management System [164]

Current management strategies include new concepts, such as *Lean Management* (increasing production by eliminating waste), the *Kaizen method* (gradual improvement, through small but continuous changes), or the *Six Sigma* method, which initially appeared as a tool to reduce variations in production processes, but which was later applied in multilateral fields, becoming a global trend [32], [48], [95].

B. Quality attributes and considerations regarding industrial equipment life cycle

Each organization with a policy focused on providing quality products must ensure that the delivered products **meet and exceed customer expectations**, comply with applicable standards, are delivered on time and under set conditions, and are available at a competitive price to ensure profit.

The same product can often be included both in the category of consumer goods and in the category of industrial products. The difference between those two categories consists of the intended purpose of the product. For example, a car purchased for personal use is a consumer good. Instead, if the same car is purchased by a company and is used for its interests, the vehicle is now considered an industrial product [14], [121].

The thesis uses as study elements industrial products such as *capital goods* from the group of *fixed assets*. Further reference to the term *product* translates into **fixed assets/equipment**.

From a commercial point of view, the quality of the products delivered by a particular supplier directly influences the profit curve and implicitly the company's turnover, so it is essential to ensure the quality of the product throughout the life cycle, namely from the need identification until the decommissioning and disposal of the product, as presented in fig. 1.5.

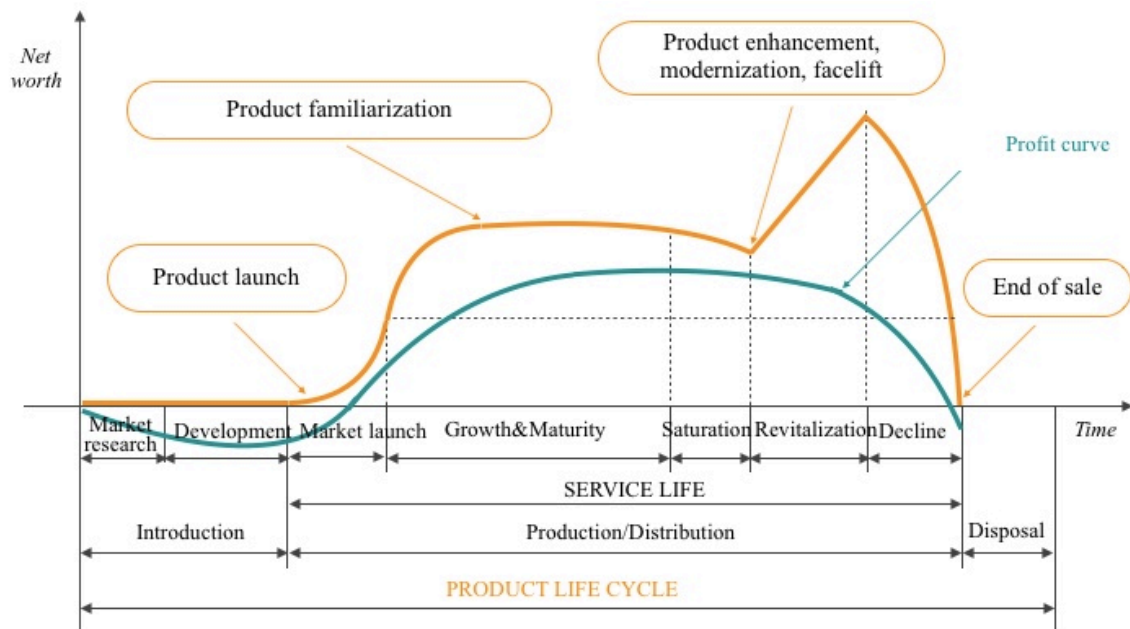


Fig. 1.5 The life cycle of industrial equipment
(author adaptation after [1], [31], [95], [140])

The life cycle of industrial equipment is relatively long. However, due to the accelerated technological progress of recent years, manufacturers need to be up to date with innovations in the field and constantly adapt their product strategies.

C. Aspects concerning optimization of the decision-making process regarding the lifetime costs of industrial equipment, based on indicators of economic efficiency

Simultaneous application of the *benefit-cost ratio* and the *expected value analysis* can support the decision-making process regarding the extension of the life of industrial equipment or the initiation of the necessary actions for purchasing a new product, with at least similar performance parameters.

D. Supply chain quality assurance

Procurement focuses on coordinating business functions (marketing, production, finance) within the company and between companies, respectively, the process known as the logistics chain or supply chain, [39], [85]. As the decision-making process is affected by the decisions of the external entities with which the company interacts, in the modern approach of organizational management, logistics moves from the stage of the internal activity of the company to the stage of supply chain management. An efficient supply chain model is that of Apple, presented by the author in the paper [69], which includes supply, production, storage, distribution, and return activities [10], [42], [88].

The author presents [73] the principles of integrating total quality management and supply chain management (fig.1.8), the steps of implementing the two strategies in a Plan-Do-Check-Act approach, as well as the benefits obtained in terms of increasing customer

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satisfaction, improving spending effectiveness, enhancing the quality of products and services, increasing employee awareness, developing close relationships with suppliers, assuring the security of goods.



Fig. 1.8 The principles of integrating total quality management and supply chain management (author adaptation after [73], [106], [129], [164], [165], [228])

The beneficiary can get more confidence in product quality by conducting an audit in the manufacturing company (as agreed in the contract), performed through its specialized bodies or a third party. The specialized literature recommends implementing a **certified ISO 9001 quality management system** [115], [163].

The author presents, in her paper [72], a series of particularities regarding quality assurance for defense suppliers, the applicable legislative framework, as well as the stages of the Mutual Government Quality Assurance process, as follows: identification, analysis, and communication of risk, the request for Government Quality Assurance and the response to the request, as well as Government Quality Assurance planning, performance and closure instructions and guidance.

1.1.2 Theoretical considerations related to risk and risk management

A. Aspects regarding the conceptual evolution of risk

The easiest way to remember the distinction between *risk* and *uncertainty* is by utilizing two notions: *to assume* and *to know for sure*. In fact, many situations are uncertain, but not all are risks. Uncertainties become risks only when they affect the objectives, hence the description of the risk as: "an uncertainty that could affect the objectives"[49], [75], [109].

B. Theoretical considerations regarding risk management

Risk management standard **ISO 31000:2018 Risk management.Guidelines** indicates the primary purpose of risk management, namely to create and protect value.

As they are not specific to a particular industry or field, risk management standards can be used by any company, association, public institution, or individual, regardless of the type and nature of the risks.

On the other hand, since it is not about promoting uniformity in risk management, when setting the implementation framework and management strategies it should be taken into account the specificity of each organization, its mission and objectives, the operational framework and organisational processes, as well as the products and services used within the company.

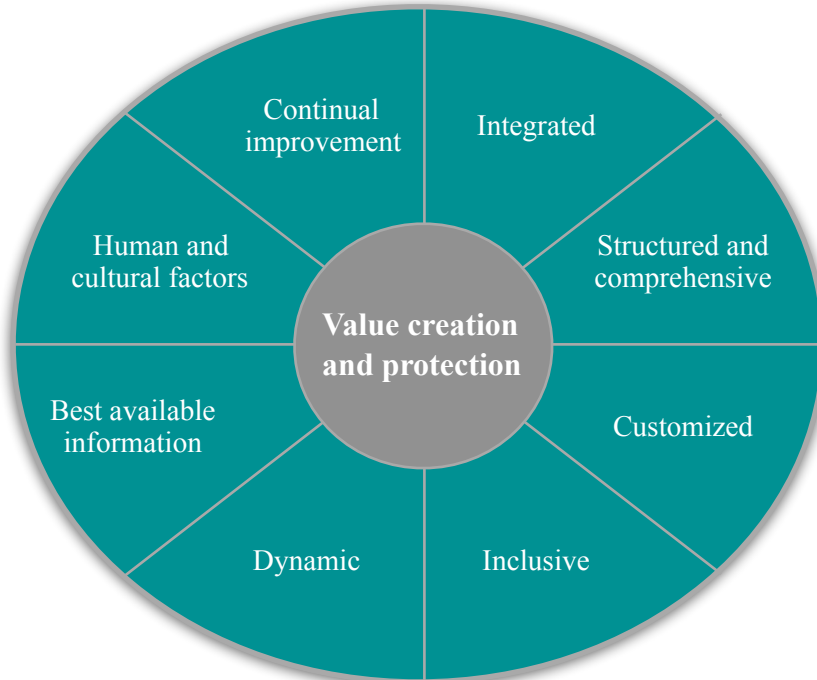


Fig. 1.9 Risk management principles (author adaptation after [166])

SR EN IEC 31010: 2020 *Risk management - Risk assessment techniques* recommends risk identification techniques such as brainstorming, Delphi technique, structured or semi-structured interviews, checklists, FMEA or HAZOP techniques, scenario analysis or SWIFT technique [162].

In public institutions, the risk assessment is performed based on the FMEA method using the impact-probability matrix with three or five evaluation steps, as was presented by the author in the paper [72].

1.2 ASPECTS RELATED TO PROCUREMENT IN A QUALITY RISK MANAGEMENT APPROACH

1.2.1 Considerations regarding the evolution of procurement legislation and regulations, at the European level and in Romania

The analysis of the evolution of Romanian public procurement legislation begins with the identification of terminology and fundamental concepts in contracting, the evolution of markets, and public sector purchasing techniques, both in Romania and worldwide.

Testimonies of extensive economic activity were recorded in Rome in 200 BC, where the army was in dire need of food, clothing, and money. The Senate then tried to regain its position at sea but was reluctant to find out that their suppliers also had supply problems. At that time, the notion of "**auction**" was first addressed. Unfortunately, the fact that there were few suppliers not only led to higher prices but also favored the emergence of various requests from them, such as exemption from compulsory military service. The Romans used to auction off things confiscated during the war [79], [94].

At the end of the 1600s, several goods like books and art objects were sold by auction. That was the first time the term **public auction** was used in official documents. Between 1700 and 1800, public auctions were used in America as a tool for the slave trade. The method appeared in Virginia but quickly became known in the south. Thus was being created the largest slave market of those times. For centuries, the practice of auctioning was associated with the idea of forced selling [175], [176] [179].

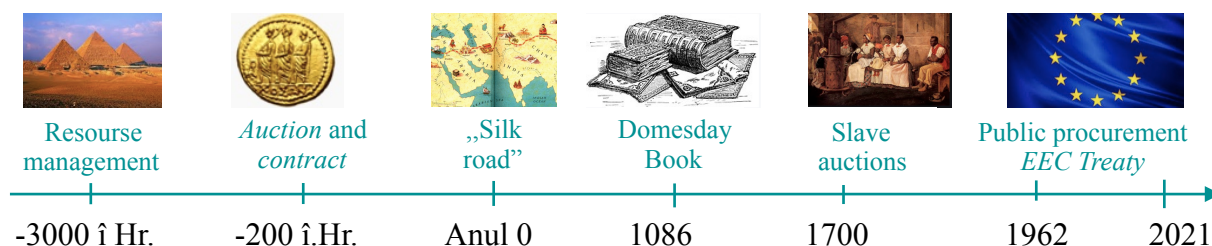


Fig. 1.13 The history of public procurement
Sources: [224]-[228]

Auctions were used in the Romanian Principalities beginning with the 19th century. During the reign of Alexandru Ioan Cuza, the first normative act regulating the field of public procurement was adopted, namely **the Regulation on public accounting**, issued in November 29, 1860. Free access to the procedure was a fundamental right of the traders, who had a specific time limit to prepare their proposals. Guarantees for participation in the auction were mandatory. The procurement process was considerably transparent. The procedures were publicly announced at least 15 days before "holding." Product specifications could be consulted by those interested, as well as the object, the terms of the procedure, and the opening date for the tenders. The adjudication took place at the end of the meeting. Following this, a report was drawn up in order to record the outcomes. Exceptional situations were also regulated, namely the "*negotiation in good faith*" (negotiated procedure without prior publication) for low-value purchases, and with the adoption, in 1864, of the *Law on General State Accounting*, the first measures were instituted regarding avoiding conflicts of interest among public employees [30].

Throughout the Second World War, auctions were limited, even interrupted, the country's economy being entirely army-oriented. After the war, Romania was included in the communist bloc, where the supply was made strictly on the basis of the principle of "quotas and distributions," and prices were imposed, identical for the same product, without competition among suppliers. Therefore, no further public tenders were held [79].

In Romania, similar to all other countries that have joined the European Union, the public procurement legislation has undergone successive changes. This fact was due to the need to fulfill the commitments assumed in order to integrate into the EU, as well as the constraints imposed by the economic and the legislative system in Romania [161].

1.2.2 The new legislative package and the principles of public procurement

In order to produce legal effects, European Directives must be transposed into the law of each state. In whatever form it appears, some elements are found in the legislation of all states, such as the principles of awarding public procurement contracts, as defined in Art. 2 paragraph (2) of Law 98 of 2016 on public procurement - hereinafter referred to as The Law (figure 1.14) [144].

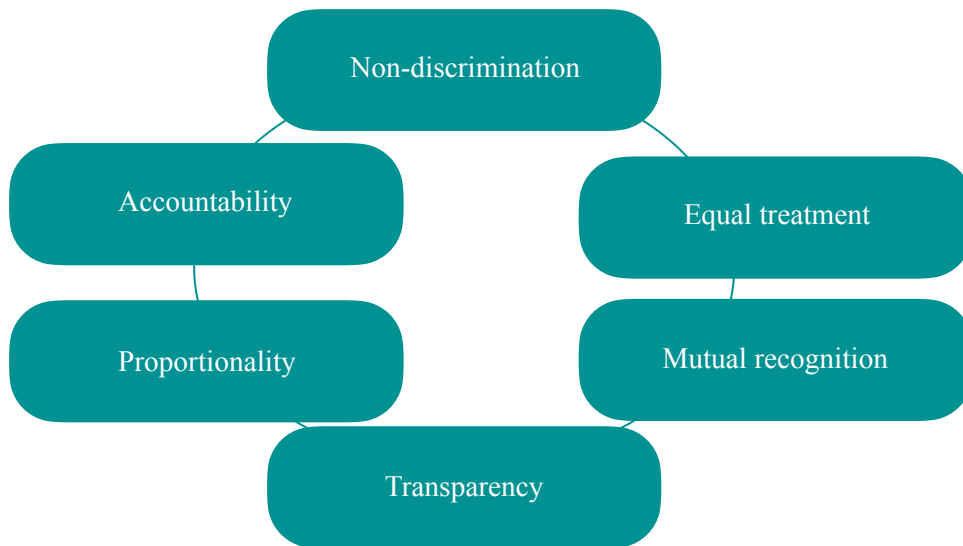


Fig. 1.14 Public procurement principles
(author adaptation after [144])

Non-discrimination and **equal treatment** aim to ensure fair competition conditions by treating potential bidders equally, without discrimination based on race, sex, religion, or other considerations. All economic operators benefit from the same conditions of competition and have an equal chance of becoming contractors.

1.2.3 Aspects related to organizing a procedure for the award of the public procurement contracts, types of procedures, the stages of the procurement process, and the risks within each stage

According to Art. 8 paragraph (2) of the Norms [153], the procurement process takes place in three distinct stages (Figure 1.15), to which is added an additional stage, analysis, and evaluation of the performance of the procurement process. The model provided by ANAP contains several activities. The sequence is presented in **Appendix I**.

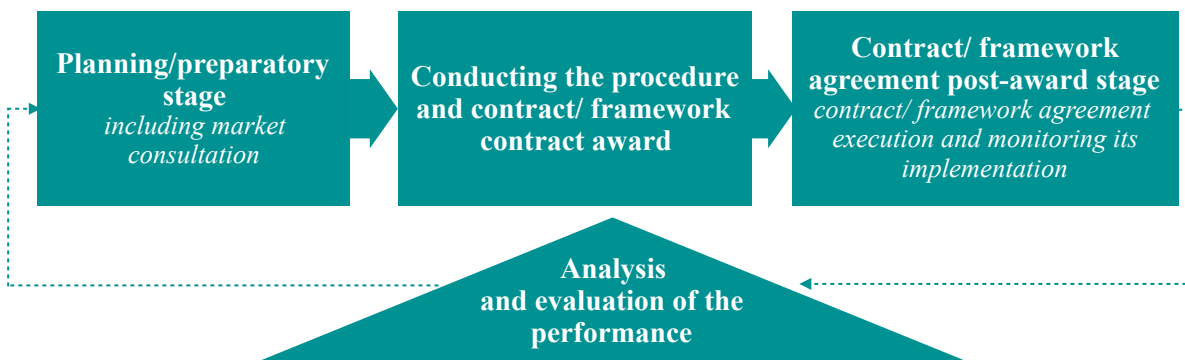


Fig. 1.15 Stages of the procurement process
(author adaptation after [144], [153], [181])

The planning stage is the most important in the procurement process; correct identification of needs and effective planning of resources directly impacts achieving performance objectives with maximum efficiency.

Depending on the regulated deadlines and taking into account the information in the requirements package, correlated with the procurement complexity level, the contracting authority set the timeline for conducting the procurement process. ANAP provides a template for the Procurement Process Timeline - open procedure, available online at [GUIDE](#)>

Procurement Process> Process Planning and Preparation> Evaluation of Necessity> Setting the Timeline [181].

The award of the public procurement contract is established on the basis of the most economically advantageous tender, determined following the application of the award criterion, using relevant evaluation factors defined in the bidding documents.

A contract regulates the legal relationship between the contracting authority and the contractor. It shall establish the communication mechanisms and the necessary actions for solving any potential problems.

Due to its nature and complexity, the procurement process is permanently exposed to risks that may vitiate the outcome of the procedure and the achievement of objectives.

Romanian public procurement legislation uses the European Commission's recommendations on the management of award procedures and identifying associated risks, regulated by a *Guide on the most common errors (...) and compliance checklist* [155].

Likewise, several risks may arise during the procurement process, regardless of the nature of the object of the contract, the law and regulations, or the contracting authority profile. They are set out in **Appendices II to IV**, in the order in which they appear during the procedural stages and together with the main preventive measures. The author presented particular considerations regarding risk management in the public procurement system in papers [68], [70] și [71].

1.3 CONSIDERATIONS ON IMPLEMENTING INTERNAL CONTROL STANDARDS IN PUBLIC INSTITUTIONS

Each public institution develops and implements its **Internal Control System**, adapted to the institution's specifics and size. Reports are submitted annually on the performance analyzes carried out within the institution, which are then presented to the hierarchically superior public entities. Sustainable implementation of internal control is being conditioned by fulfilling a few general requirements [190].

All employees contribute to the fulfillment of institution performance objectives so that the evaluation of the internal control system involves evaluating the staff's professional performance in relation to the specific objectives in the job description.

1.4 ASPECTS REGARDING THE PROCUREMENT FROM ISO 9001:2015 AND THE ISO 31000 FAMILY OF STANDARDS VIEWPOINT

1.4.1 Establishing the quality assurance requirements in the procurement and transposing them into contractual terms

Table 1.15 Quality assurance requirements set in the *Terms of Reference/Scope of Work*

<i>The Terms of Reference/Scope of Work</i>	
YES	NO
<ul style="list-style-type: none"> - technical characteristics and performance criteria, provisions for safe operation, dimensional characteristics, quality assurance systems, terminology and symbols, tests and test methods, requirements for packaging, labeling or marking, and conditions for certifying compliance; - reference to standards. 	<ul style="list-style-type: none"> - inappropriate, vague (non-specialized) terminology; - quality requirements defined using terms such as "highest quality," "best product on the market;" - technical conditions that are discriminatory or favor certain economic operators, indications to certain sources, origins, trademarks, distinctive production processes, patents, or licenses.

(author adaptation after [157], [189])

The quality of the products is attested by the warranty Certificate and the Declaration of Conformity, signed documents, authenticated by stamping and containing all the information provided by the legislation in force, inscribed legibly, explicitly and unambiguously [149].

1.4.2 Public procurement key performance indicators. Relevant aspects regarding risk management in procurement

At the same time, the performance in public procurement translates in terms of efficiency, compliance with the procedure timeline, and in accord with the Annual Public Procurement Strategy. The symbiosis between the notions of *quality assurance*, *efficient use of public funds*, *sustainable development*, and *effective risk management* is the basis of the **value for money** concept, often encountered in the modern business environment, oriented towards innovation, development, and continuous improvement.

The author addressed the topic of improving the performance of public procurement at a conference held at the Defense Staff, presenting a platform concept to simplify communication between and within organizations and streamline risk management in the procurement process [70].

Public customers usually pay more for the same product than private customers due to the different approaches to risk management practices in the public / private spheres. The price paid by the buyer is:

$$Price = Supply\ chain\ costs + The\ risk\ assumed\ by\ the\ supplier + Profit \quad (1.4)$$

The price can be defined according to the risks as follows: the more risks the public authorities delegate to the supplier, the higher the final price of the product. Therefore, a common risk management strategy could be a viable solution to streamline spending and improve the performance of the procurement process.

There are certain key moments in the procurement process when it is appropriate to conduct risk assessment meetings before moving on to the next stage, as identified by the author in the paper [71].

1.4.3 The opportunity to implement an integrated quality management system in procurement. Preliminary conclusions and research objectives

Tabelul 1.19 Risk management in the public sector

Characteristics	Risk management, based on the requirements of:	
	<i>Internal Control</i>	<i>ISO 31000:2018</i>
<i>The relationship between risk management and organizational strategy</i>	Low influence of risk management on the planning of organizational strategies	Risk management provides effective support in strategic planning processes
<i>Risk management approach</i>	Focused on threats	Focused on threats and opportunities
<i>Risk assessment</i>	According to the established program and methodology, analyzed in a reactive approach	Continuously, as required and approached in a proactive manner
<i>Risk management</i>	Performed by "specialists"	Information on risk management is centralized at all departments
<i>Risk recording</i>	Risk mapping is unstructured and incomplete	Clear and complete reports
<i>Risk communication</i>	Only to those responsible for specific tasks	Awareness of all staff about the importance of communicating relevant risk information
<i>Allocation of responsibilities</i>	When allocating responsibilities, certain types of risks are "overlooked"	The proper designation of those responsible for managing all types of risks and utilizing rewards

(author adaptation after [23], [158], [166])

CHAPTER 2

FUTURE RESEARCH DIRECTIONS IN THE STUDY

2.1 CURRENT RESEARCH TRENDS IN RISK ASSESSMENT AND INTEGRATED QUALITY RISK MANAGEMENT IN THE PUBLIC PROCUREMENT SYSTEM

Following the bibliographic research in quality and risk management, it can be noticed that most current studies are focused on applying quality management techniques and tools in organizations with an industrial profile or in multinationals outside Romania. Strategies are also being developed to increase corporate profitability or risk analysis methods. However, **there is no interest in improving the procurement process** or finding practical solutions to barriers such as bureaucracy, inefficient spending of public funds, or overburdening procurement specialists.

Current trends in risk management research are supporting the idea that the competitive advantage of an organization lies in the effectiveness of decision-making and the ability of managers to make quick decisions, taking into account the risks that may affect objectives, but especially their mastery to turn threats into opportunities.

On the other hand, in the private sector, the concept of *an integrated quality risk management system* is already rooted in the vision and strategies of most successful companies, gaining new dimensions and perspectives and resulting in the organization's sustainable development.

2.2 DELIMITATIONS OF THE STUDY

The implementation of a quality management system in a public institution is a valid **proof of its commitment to quality and, directly or indirectly, of care for citizens** while demonstrating the ability of management to integrate the concept of "value for money" in the organizational strategy, also taking into account the procurement and the internal control laws and regulations.

In the context of the numerous legislative changes in public procurement and the increased interest regarding the efficiency of spending public funds, the concept of **quality and risk management in procurement becomes actual and particularly complex, thus necessary to delimit the field of research in a specific and approachable framework for a doctoral thesis.**

2.3 RESEARCH AIMS AND OBJECTIVES

IV. Integrated quality-risk management in the procurement of industrial equipment, as follows:

- development of an integrated quality risk management system for a public institution: the stages of developing and implementation of the integrated management system, factors influencing its implementation and the resulting advantages;
- optimizing the public procurement process by redesigning the procedure timeline and integrating quality management and risk management at procedural stages;
- development of a framework model for procurement of industrial equipment;

- case study on improving the public procurement process by developing an IT application for resource management and support in planning and conducting public procurement;
- study on approaching procurement as a project and using the Monte Carlo method for simulating the procedure timeline in conditions of risk or uncertainty;
- development of the function of evaluating the performance of the procurement and the degree of fulfillment of the objectives based on the satisfaction surveys.

CHAPTER 3

THEORETICAL DEVELOPMENTS AND CONTRIBUTIONS REGARDING QUALITY AND RISK MANAGEMENT IN PUBLIC PROCUREMENT

3.1 CONSIDERATIONS REGARDING THE IDENTIFICATION OF RISKS IN PUBLIC PROCUREMENT

3.1.1 Studies and theoretical contributions on identifying the main internal and external factors that may influence the procurement process

This study addresses the topic of purchasing industrial equipment in the category of capital goods, the subclass of fixed assets. There are many examples, but the paper will refer to industrial equipment with high value and high complexity, such as forklifts, mobile cranes, multifunctional terraces. The study will be carried out taking into account an institution financed from the state budget (which will maintain its confidentiality, hereinafter referred to as **LOGIST**) designated to procure several pieces of equipment of the mentioned category.

There is a wide range of potential factors that can have an impact either positively or negatively on the procurement process, their identification is the starting point in assessing the institution's ability to achieve the intended results.

Understanding the context of procurement means analyzing external and internal issues, in order to determine as accurately as possible the needs and expectations of stakeholders, but especially to ensure compliance with the Annual Public Procurement Strategy and the timing of the procedure.

3.1.2 Managing ethical risks in the award of public contracts

There are several official reports and studies on corruption and the performance of the procurement system in Romania ([36], [193], [194], [197], [200]-[202], [206], [209], [210]), the author presented in [71] some particular considerations regarding how bribery works in public procurement and the main risks associated with the procurement process.

Contracting authorities face numerous ethical risks that may affect the achievement of the objectives, regardless of the object of the procurement or the value of the contract. The probability of occurrence varies, but the impact is always critical. Ethical risks cause severe damage to the procurement process, so authorities will take a set of measures to prevent their occurrence, such as [171]:

- promoting a transparent procurement framework based on fairness, impartiality, and equal treatment of tenderers;
- the commitment of decision-makers to ensure a code of ethics within the organization and in connection with public procurement procedures.

3.2 THEORETICAL CONTRIBUTIONS TO IMPROVING PROCUREMENT PLANNING IN A RISK-BASED APPROACH

3.2.1 Qualitative risk analysis using SWIFT technique and scenario analysis. Development of Gantt charts for optimizing the procedure timeline

The fastest and most intuitive way to analyze risks in the planning phase of the acquisition process involves applying the technique "what if" - SWIFT and creating scenarios that reflect "the best case," "the worst case," and "the expected case."

The person in charge of the acquisition develops the scenario in the expected version, presenting the sequence of the main events, the timeline, and the associated risks. The discussions take place in stages, and depending on the plausible change of parameters, a series of scenarios are proposed. Depending on the experience of the meeting participants and the effects of the risks identified in similar procedures, the vulnerable situations to be monitored are established, as well as the necessary control tools.

The results obtained for the three scenarios are represented in **Appendices V-VII**, elaborated on the basis of Gantt charts [113] and having as coordinates the time (days), indicating the start and end dates of the activities respectively their duration. The expected variant will be approved and uploaded to SEAP and sent for ANAP analysis, being taken into account when establishing the timeline.

3.2.2 Quantitative analysis of risks in procurement using tree diagrams

A. Contributions regarding the elaboration of a tree diagram for selecting the acquisition objective

One of the techniques for quantitative risk analysis in procurement uses tree diagrams, which graphically and quantitatively describe the interactions between decisions and certain random events that may affect the achievement of procurement objectives.

The level of subjectivism is given by the influence of human factors, uncertainty about the availability of funds, or lack of information about the current market. The values of the terms used in the analysis are estimated using information gathered from similar procedures.

The branches of the tree represent either decisions or unpredictable or unforeseen results, respecting the following two rules:

- the probabilities on each branch and subbranch multiply
- the sum of the probabilities associated with a node is equal to 100%

B. Contributions to the development of a tree diagram to identify the main causes of delays in delivery

The process is applied as follows: first, identify the main source of risk and likelihood of occurrence; based on successive calculations, identify the primary causes that determine the risk, as well as the probability of their materialization.

Data collected from similar procurement procedures are used. The tree diagram is represented in figure 3.3.

Thus, the possible causes of delivery delays are:

1. *Supplier causes* - with a probability of 60%:

1.1. Delayed production - with a probability of 30%, because:

1.1.1. The supplier does not receive the equipment from the manufacturer on time - with a probability of 60%.

1.1.2. The equipment is not complete with all accessories - with a probability of 40%.

1.2. Transport difficulties - with a probability of 30%, as the supplier has:

- 1.2.1. Difficulties in obtaining import licenses - with a probability of 60%.
- 1.2.2. Accidents, carrier delays - with a probability of 40%.
- 1.3. Issuing authorisations - with a probability of 40%, due to the overloaded schedule of public authorities, especially at the end of the budget year.
- 2. Causes related to the purchaser - with a probability of 10%:
 - 2.1 Procurement issues - with a probability of 40%, for the following reasons:
 - 2.1.1. Incomplete requirements / no reference to standards - a probability of 20%.
 - 2.1.2. Incomplete award documents - with a probability of 80%.
 - 2.2. Inefficient communication between the parties - with a probability of 30%.
 - 2.3. Lack of storage space required to perform reception tests - with a probability of 30%.
- 3. Other causes (relating to external parties) - with a probability of 30%.

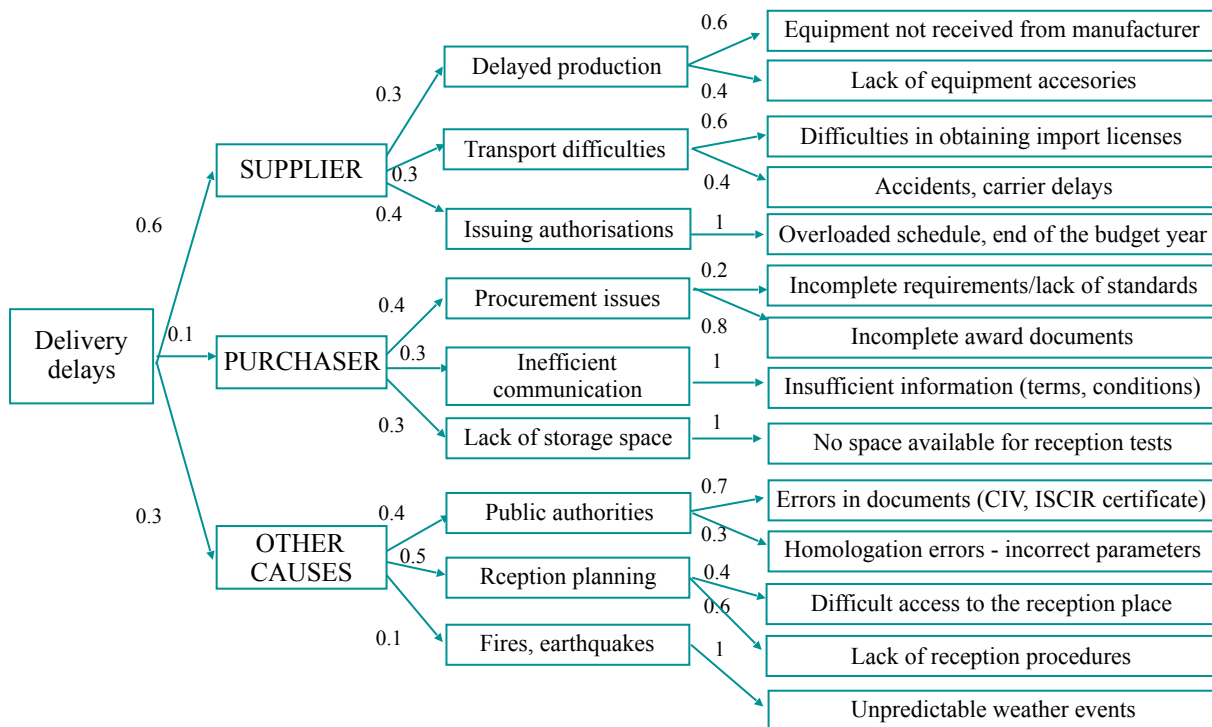


Fig. 3.3 Tree diagram for identifying the causes of delivery delays (author contribution)

Analyzing the information on the third level of the tree, the probabilities of the causes of delivery delays are, as follows:

- the likelihood that the supplier will not get the equipment in time:
 $P(1.1.1.) = P(1.1.) \times 0.6 = 0.108$ (or **10.8%**)
- the probability that accessories do not accompany the product:
 $P(1.1.2.) = P(1.1.) \times 0.4 = 0.072$ (or **7.2%**)
- the likelihood that the supplier will have difficulty obtaining import licenses:
 $P(1.2.1) = P(1.2.) \times 0.6 = 0.108$ (or **10.8%**)

Thus, analyzing the causes of the delays, the following conclusions can be drawn:

- the probability that the supplier will not obtain authorizations (Vehicle Identity Card, ISCIR certificate etc.) on time or that they will be received with incorrect information is high, mainly due to the agglomeration of public authorities at the end of the budget year; therefore, measures will be taken to conclude the contract as close as possible to the beginning of the year;
- another common cause of delivery delays is the delayed receipt of equipment from the manufacturer, including delays caused by transport and obtaining import licenses;

- the lack of contractual provisions related to reception costs (eg fuel, batteries etc.) and responsibilities of the parties may lead to delays in reception. The contract must include a liability clause for providing the tools and consumables necessary to perform the reception tests.

C. Contributions to the development of a tree diagram to identify the main causes of the delivery of non-compliant equipment

D. Contributions to the development of a tree diagram to identify the main causes of the inefficiency of the procurement process in terms of human resources

3.2.3 Regrouping the main categories of risks specific to the procurement planning stages by developing questionnaires with control points

Using the procedure timeline, for the example analyzed above, it will be identified vulnerable situations that may affect the procurement planning stage, with direct effects on the procedure outcome. For this purpose, a questionnaire with 15 control points will be used, each of them having two-three-four variants with a specific score (1-5), through which the risk can be analyzed before starting the following activity from the procedure timeline.

The checklist includes a series of questions whose answers allow to outline a factual situation, providing assistance in deciding whether or not to start a procurement procedure (**Appendix VIII**).

Thus, after answering the questions and calculating the score by summing the scores for each answer, the results are interpreted as follows:

- between 15 and 20 points - the conditions for starting the procurement are ensured, the procurement process is monitored and the employees perform their tasks;
- between 21 and 45 points - starting the procurement procedure is vulnerable, some factors may cause difficulties in certain stages, but the procurement process is not affected;
- between 46 and 75 points - the acquisition is risky, and the contracting authority will postpone the publication of the Award documents. It will reevaluate risks at all stages until there is a certainty that the process is entirely risk-free.

The questionnaire results are divided into three categories, depending on the impact that, under certain conditions, the start of the procedure may have on the achievement of the objective. Depending on the results obtained, a decision can be made as to whether or not to initiate the procedure.

Similarly, the questionnaire can be used to identify potentially vulnerable and risk-generating situations that arise after the publication of the award documents by iterating activities related to the procurement process and allocating scores according to the appropriate intervals.

3.3 STUDY ON CARRYING OUT PROCUREMENT PROCEDURES IN A RISK-BASED APPROACH

3.3.1 Developments regarding the use of *root cause analyses* for determining the main factors that can influence the procedure outcome

For example, in the following it will be presented the cause-root analysis in the procurement process [15], taking into account the case of industrial equipment with the specifics mentioned.

The key elements considered are *the procurement process, employees, contract, acceptance procedures and testing equipment*.

3.4 OPTIMIZING THE PROCUREMENT PROCESS BY REDESIGNING THE TIMELINE AND INTEGRATING RISK MANAGEMENT AT THE PROCEDURAL STAGES

3.4.1 Design, implementation and improvement of the integrated quality risk management system in a public institution with procurement competencies for industrial equipment

A. The general framework for implementing the quality and risk management system in a public institution

LOGIST is financed from the state budget, so it is subject to all laws and regulations regarding the efficiency of spending public funds, the general manager having an obligation to ensure that the procurement system is efficient and provides the necessary framework for achieving the expected results, but also the obligation to facilitate the incorporation of a risk management policy into the management strategy, including on procurement ethics risk.

The guarantee of obtaining successful acquisitions every time is the simultaneous approach of the two key concepts: quality and risk, by developing an organizational framework that integrates the risk management in all the processes of the institution, in its strategies and management, but also in its values and organizational culture.

Therefore, the necessary actions are being taken to implement an integrated quality-risk management system according to the standards in the ISO 9000 and ISO 31000 series, but at the same time in compliance with the Internal Control Code and taking into account legislative compliance as a minimum standard.

The integrated quality-risk management system can be implemented in any public institution, regardless of its nature or specificity.

Therefore, LOGIST aims to adopt best practices and standards in the field of quality and risk, so that through the procurement department and with the unconditional support of all departments involved in the procurement process to conclude contracts on favorable terms, with the fundamental aim of obtaining "value for money."

B. Procedural diagram of procurement management in a quality-based approach

C. Integration of risk management at the level of LOGIST compartments

The LOGIST institution is structured on hierarchical levels, in the form of compartments, each consisting of several offices, which carry out specific procurement activities, budget planning, marketing and merchandising, contract monitoring, but also other activities in support of the procurement department, as follows: specialized legal assistance, human resources management, financial-accounting services, logistics - responsibilities in transport, handling, reception and storage of products.

The design of the organizational framework for risk management has as a starting point the identification of the internal and external context of the organization. The external factors that interact with the institution and that can affect its processes are taken into account. Through SWOT analysis, the internal factors that affect the management system of the institution are also identified.

Procurement management in an integrated quality-risk approach involves carrying out activities during 4 stages, according to the PDCA model, namely procurement planning, procurement execution, performance analysis, and performance improvement, in which regular risk analysis sessions take place (Figure 3.11).

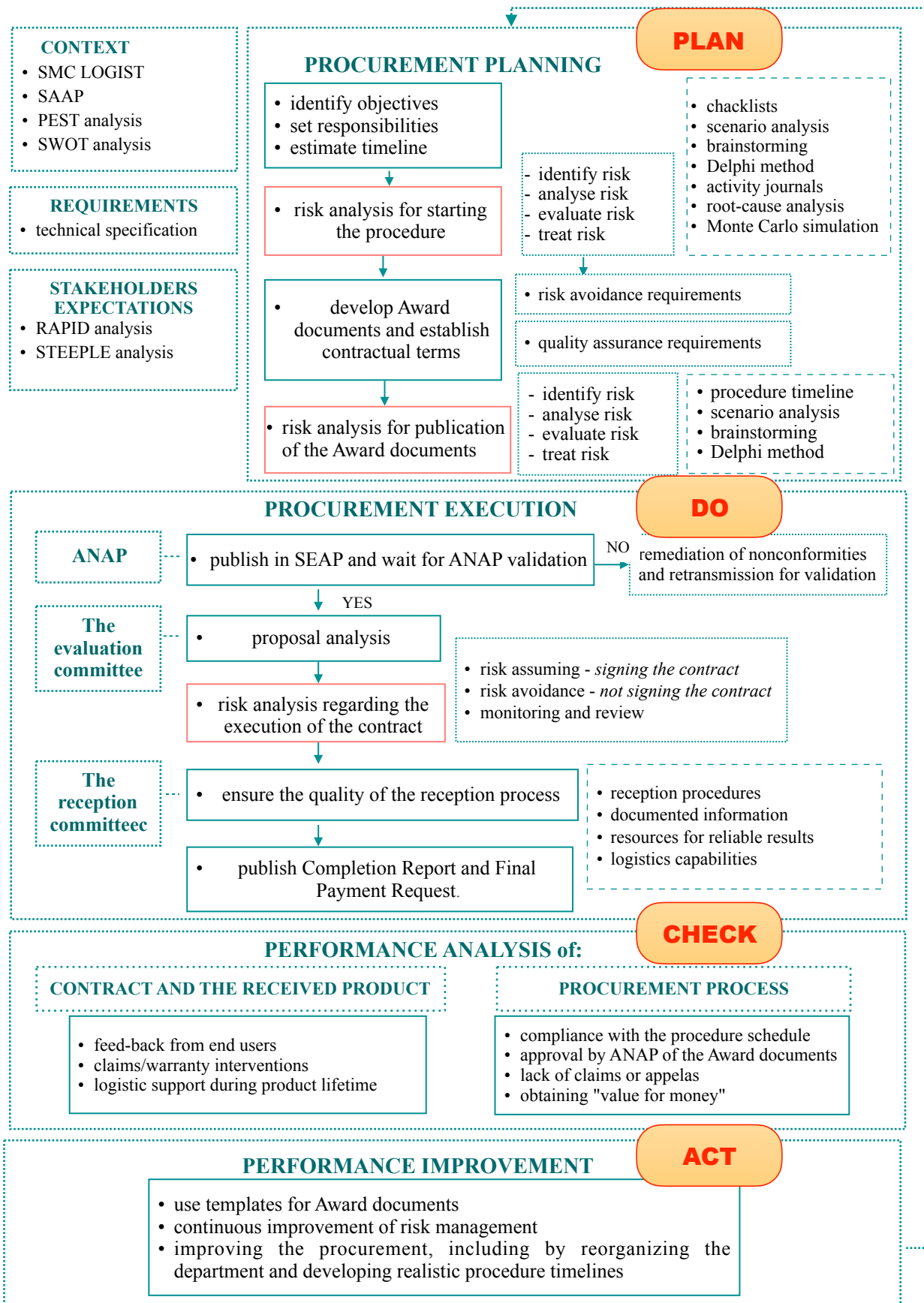


Fig. 3.11 Procedural scheme of procurement management in an integrated quality-risk approach (author contribution)

Although risk analysis meetings are performed only at specific strategic points during the procedure, the risk-based approach includes risk in all decisions taken by staff with different responsibilities in the procurement procedure, including evaluation committees, end-users, or the receiving committees. However, the planning stage is the most important; an in-depth analysis of the influencing factors and an efficient allocation of resources allows the development of a more realistic timetable of the procedure so that depending on the complexity of the procedure and the constraints identified, decision-makers can adopt the best strategies.

D. Resources management in LOGIST

The general manager is committed to allocating all appropriate resources for quality and risk management, such as human, material, and financial resources, documented procedures, modern and efficient methods and tools, information technology, and effective means of communication, participation in professional development courses, and continuous training.

E. The procedure for assessing customer satisfaction and handling complaints

The *Customer Satisfaction Assessment Form* is generated based on the centralized data received from customers. The evaluation of the process is performed by calculating the total score accumulated from the marks awarded for each answer. The conclusions are introduced in an *Evaluation Form*, and the results and the customers' suggestions are presented and analyzed in the management analysis sessions.

F. Management analysis

LOGIST top management analyzes, at least annually and whenever necessary, the integrated quality-risk management system in order to ensure that it is still proper, adequate, and effective. The analysis includes possible opportunities for improvement and whether there is a need for change or not. The meeting is attended by the management team and the heads of departments.

G. Risk management in industrial equipment procurement

Considering the provisions of the risk standards ISO 31000, the LOGIST institution, whose primary mission is to conduct procurement procedures, will integrate the risk management process in the structure, operations, and organizational processes. The process is performed according to the following iteration (figure 3.13):

a. Communication and consultation

Communication and consultation with external and internal stakeholders take place during all stages of the risk management process. Meetings occur at planned intervals between specialists from different fields, with specific responsibilities in the direction of risk management, to analyze and agree on specific strategic measures and decisions.

The internal information network facilitates communication within the institution and with stakeholders within the Ministry. Employees are permanently connected and can meet to analyze imminent risks or whenever the situation requires it.

With regard to information exchanged with the external environment, as it may contain confidential information, contractual terms or information relating to the procurement process must be carefully disseminated and communicated to external stakeholders only by fax or e-mail.

b. Establishing the context

Understanding the organization and the context is made by analyzing the relevant internal and external factors in risk management, followed by establishing the scope and risk criteria.

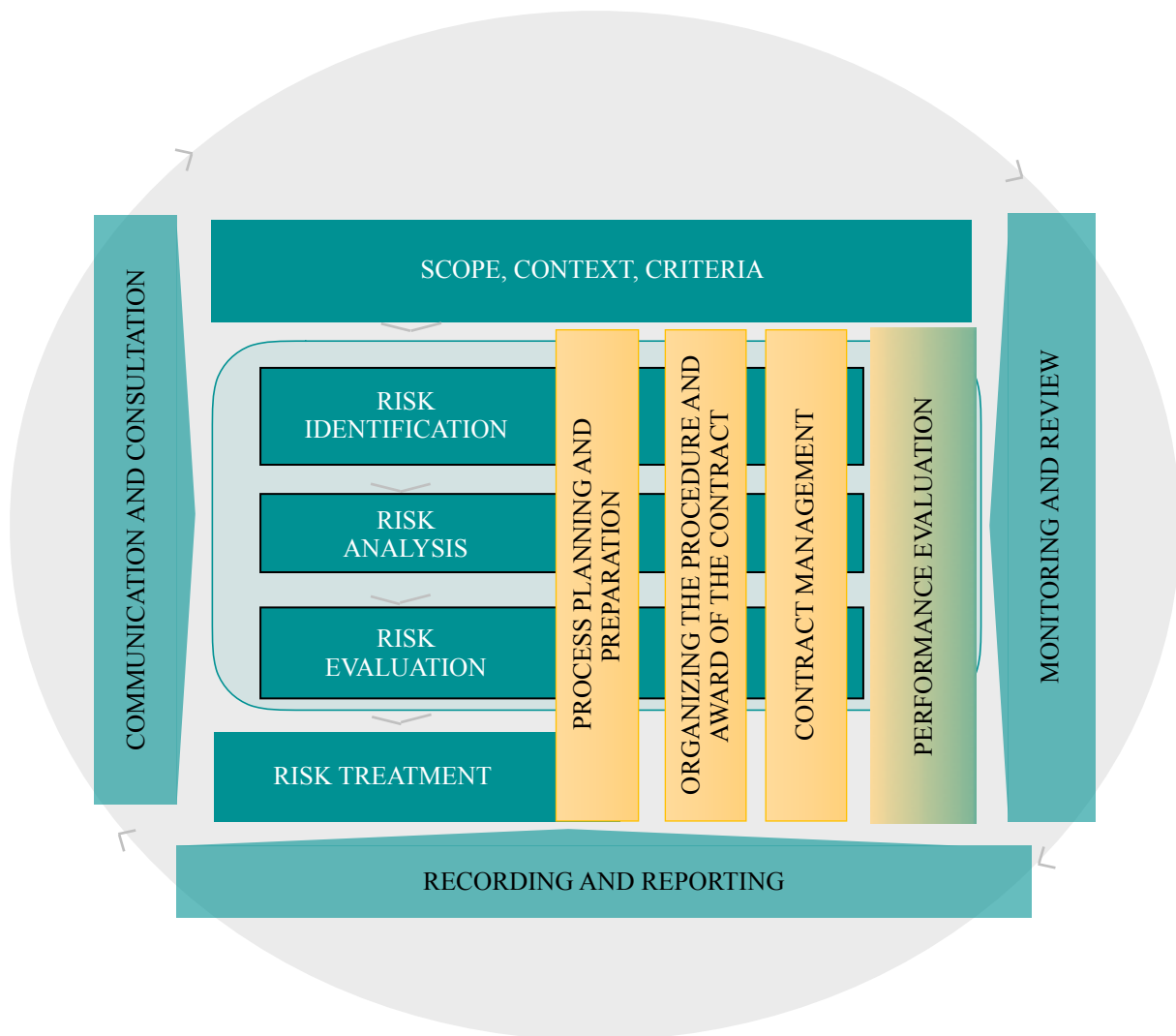


Fig. 3.13 Risk management in public procurement
(author contribution based on [71], [166], [181])

Undoubtedly, the focus should be on internal factors such as the quality, experience, and motivation of staff, together with the involvement of the general manager and directing the employee towards a risk-based approach and the adoption of risk management measures according to their likelihood of occurrence and the impact on the outcome of the procedure.

c. Risk assesement

The first step in risk assessment is the inventory of all LOGIST activities and the relationships between departments, and how they communicate with each other. All sources of risk, their nature and the causes of risks are then identified, ans well as the potential consequences of their materialization. The number of risks increases in proportion to the complexity of the institution's field of activity and the number of activities carried out to achieve the objectives. Risk identification should be made on an ongoing basis and the techniques should be permanently adapted to changes.

The risk assessment must use objective, impartial evidence and take into account all vulnerable situations, while risk exposure and risk tolerance are adequately defined. Examples of risk identification methods and information collection techniques are indicated by the standard SR EN IEC 31010: 2020 Risk management. Risk assessment techniques. These include checklists, SWIFT analysis, Ishikawa diagram, structured interviews, brainstorming, Delphi technique.

3.4.2 Developments and contributions to the development of a framework model for the award of a public procurement contract for an industrial equipment

A. Establish the procedure timeline and allocate responsibilities

For the present study, it is considered that through the *Annual Public Procurement Strategy* for 2019, the LOGIST institution will purchase **10 (ten) forklifts for handling materials**. These pieces of equipment will be used in the warehouses of the logistic structures.

B. Analysis of the relationship between the object of the contract and the ability to manage the public procurement process

C. Obtaining the best value for money by choosing the optimum award criterions

The award of the contract is performed taking into account the most economically advantageous offer. In this sense, LOGIST uses the award criterion **best price-value-quality ratio**, adopting the following technical and qualitative evaluation factors:

- evaluation factor 1 - *price* (weighting factor 80 %);
- evaluation factor 2 - *fuel consumption*¹ (weighting factor 10%);
- evaluation factor 3 - *additional warranty* (weighting factor 5%);
- evaluation factor 4 - *sound level in cabin* (weighting factor 5%).

The choice of factors was made for technical and economic reasons, but also taking into account the care for the environment and product operators by giving additional scores to those products offered that meet particular requirements, such as low resource consumption or low noise inside the cabin.

The total score obtained from a bid is calculated as follows:

$$\text{Total score} = \text{evaluation factor 1 (price)} + \text{evaluation factor 2 (consumption)} + \text{evaluation factor 3 (warranty)} + \text{evaluation factor 4 (noise)} \quad (3.1)$$

The hierarchy of offers is established according to the total score. An offer can get a maximum of 100 points.

The contract is awarded to the tenderer with the highest score.

a) The points for the evaluation factor "price" with a weight of 80% of the total award criterion will be assigned as follows:

- for the admissible offer with the lowest price: 80 points;
- for the other admissible offers, the points will be calculated as follows:

$$P_{\text{price}(i)} = \text{Price}_{(\min)} / \text{Price}_{(i)} \times 80 \quad (3.2)$$

in which:

$P_{\text{price}(i)}$ represents the result score for the admissible offer under evaluation;

$\text{Price}_{(\min)}$ - the lowest of the admissible bid prices;

$\text{Price}_{(i)}$ - the price of the admissible tender under evaluation.

¹ According to VDI60 cycle (VDI 2198:2012-12 *Type sheets for industrial trucks*)

In this context, by choosing an award criterion based not only on price but also on quality, the LOGIST contracting authority can obtain superior values for the performance parameters and the functional characteristics of the products.

D. Elaboration of quality assurance requirements and their transposition in contractual terms

The procurement department of LOGIST must take into account that in the specifications, in DUAE, in the Award documents, as well as in the contract, quality assurance requirements are specified, and the equipment supplier must have a certified quality management system or provide evidence of an appropriate level of quality equivalent to that required.

The context of procurement

a. The contracting authority

LOGIST is a public institution that has in its portfolio logistical activities, such as the purchase of fixed assets - for its benefit, and for the institutions from the same ministry, supply of goods and services (by transfer from other public entities, donation, leasing or other financial instruments) or the qualitative and quantitative reception of high complexity products, transport, and storage of goods, etc.

b. Information about the context of procurement

Based on the Annual Public Procurement Strategy for 2019, the LOGIST institution is designated to purchase ten forklifts for handling materials with a lifting capacity of at least 2,500 kg, necessary for the current activities of the warehouses in the logistics structures of the Ministry.

Currently, customers use forklifts from the same range, but outdated, uneconomical, and very low reliability, adding a high level of noise and NOx emissions. No constraints are affecting the award procedure in the 2019 budget year.

Description of the procurement

Contract documents

Reception

Payment terms and conditions

The legal framework governing the relationship between the contracting authority and the contractor

Contract management and reporting within the contract

The procurement managers prepare, verify and publish all documents in SEAP, estimate the funds related to the contract, download the documents submitted by the bidders and present them to the evaluation committee, respond and submit requests for clarifications, publish on SEAP the documents resulting from the evaluation committee's analysis, and after establishing the best proposal, they invite the tenderer to the headquarters of the contracting authority, to sign the contract.

Ensuring the quality of the procurement and the quality of the product received

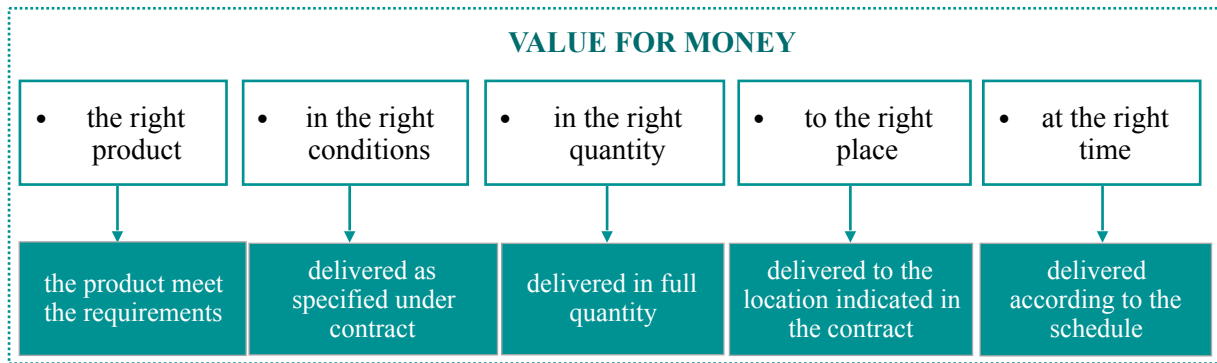
Achieving the procurement performance is conditioned by effective quality management, with clear directions of action, which has as a reference the quality assurance of the procurement process and of the received product. Some of the key elements are systematically presented in Table 3.13. Broadly, the implementation of the contract should lead to obtaining value for money, having as reference the elements in table 3.14.

Table 3.13 Ensuring the quality of the procurement/the product received (author contribution)

<i>Terms and conditions</i>	<ul style="list-style-type: none"> ● a mechanism for changes should be included in the contract (eg exchange rate fluctuations and price indexation)
<i>Reference to standards</i>	<ul style="list-style-type: none"> ● precise requirements with reference to standards helps the potential bidder to understand the needs in order to develop the bid that meets the specified requirements
<i>ISO Certificate</i>	<ul style="list-style-type: none"> ● the implementation of a quality management system gives confidence in supplied products, also becoming an important factor in increasing the credibility of the suppliers
<i>Certificate of Warranty</i>	<ul style="list-style-type: none"> ● it accompanies the products upon delivery and certifies that the products meet the legal and regulated quality and guarantee conditions; accredits that the delivered products correspond to the purpose they were created and fall within the quality parameters specified in the technical documentation accompanying them. The products are guaranteed against any hidden defects or manufacturing defects during the specified period, but only if operated according to the manufacturer's instructions.
<i>Declaration of Conformity</i>	<ul style="list-style-type: none"> ● the supplier guarantees that the products delivered do not endanger life or health and do not produce a negative impact on the environment, and comply with applicable European and international regulations [26]
<i>Install and run tests</i>	<ul style="list-style-type: none"> ● it is a component of the reception process; includes the activities carried out for the preparation of the product in the final configuration, so that until receipt any problems that could prevent its operation at the specified parameters are eliminated.
<i>Reception tests</i>	<ul style="list-style-type: none"> ● the main purpose is to verify that the supplied product meets the requirements of the specifications; it is carried out by the staff indicated by the contracting authority (usually a commission composed of representatives of the beneficiary), and the activities are carried out on the basis of a reception procedure. At this point, the beneficiary assumes ownership of the product, registers it in their own accounts and assumes full responsibility for the associated risks.
<i>Warranty provisions</i>	<ul style="list-style-type: none"> ● correlated to the requirements of the <i>Terms of Reference/Scope of Work</i> and include actions to repair defective parts through no fault of the user, as specified in the contract document, including compensation to the beneficiary for any hidden defects.
<i>The payments</i>	<ul style="list-style-type: none"> ● the payments must be performed within the stipulated contractual terms; any unjustified delays may affect the relationship between the supplier and the contracting authority. The contracting authority must take measures so that on the date specified, it has the necessary funds, has all the supporting approvals, and can transfer the established amount of money through the Treasury.
<i>Post-contractual review</i>	<ul style="list-style-type: none"> ● compares product performance by reference to the specified and accepted criteria; thus, it is verified if the beneficiary is satisfied with the purchased product. The activity aims at continuous improvement of the procurement process, offering both the opportunity to record the performance of the economic operator, for future references, and to evaluate the activity of the procurement team of the contracting authority, collecting lessons learned
<i>Termination clause</i>	<ul style="list-style-type: none"> ● some contractual clauses, such as confidentiality clauses, may remain valid even after the formal termination of the contract
<i>Continuous improvement</i>	<ul style="list-style-type: none"> ● it uses the information collected in the post-contractual review and aims to assess the degree of fulfillment of all established performance indicators and identify issues that can be improved for future procurements

Value for money means much more than delivering compliant products at the lowest possible price. It involves their delivery on time and under the conditions specified in the contract, together with providing a complex package of services, such as theoretical and practical training of operators or installation of equipment and conducting reception tests, to support their compliance.

Table 3.14 Obtaining "value for money" (author proposal)



The supplier shall also provide the contracting authority with all the technical documentation necessary for the proper operation of the equipment throughout its life, together with a preventive and corrective maintenance plan, the supplier assuming by contract the prompt restoration of the products in working order, in if defects that have not been caused by the user's fault are identified during the warranty period.

Approaching procurement as a project, quality can be assessed from two perspectives: *the quality of the procurement process* and *the quality of the product received* (Figure 3.14).

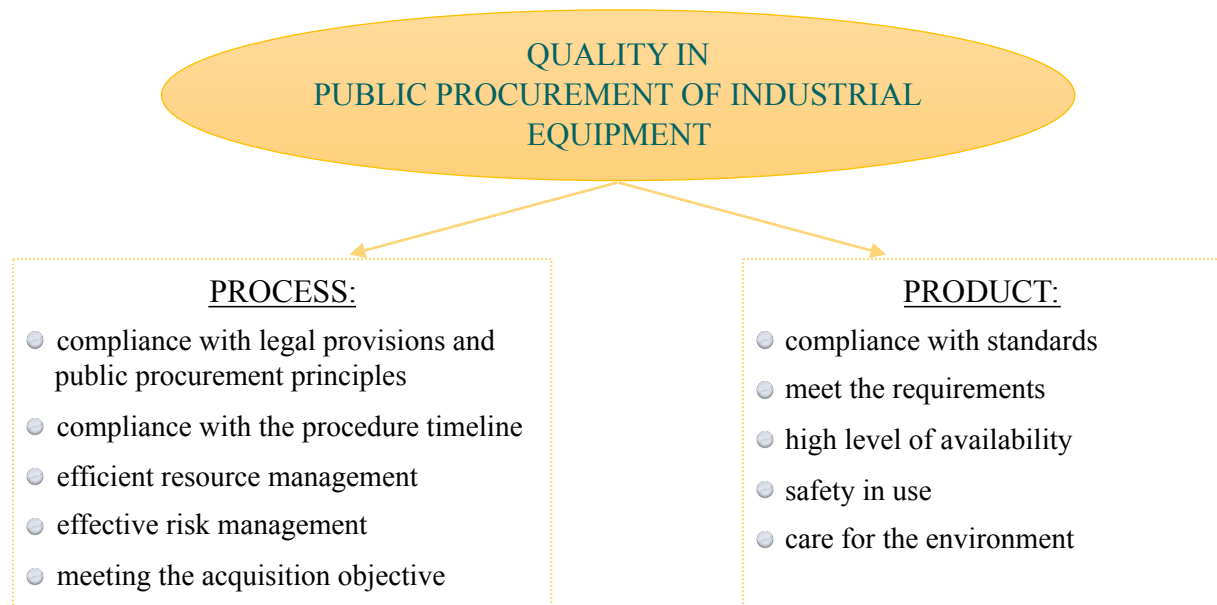


Fig. 3.14 Quality of the procurement process and quality of the product received (author proposal)

By implementing a quality management system based on the standards of the ISO 9000 family, the contracting authority proves its awareness and interest both in the development of equitable and transparent collaborative relationships with potential contractors and in terms of care for employees and customers through rigorous planning and management of resources and a concentration of all efforts towards supplying the institution with goods and services that meet expectations.

CHAPTER 4

APPLICATIVE CONTRIBUTIONS AND CASE STUDIES ON INTEGRATED QUALITY-RISK MANAGEMENT IN THE PROCUREMENT OF INDUSTRIAL EQUIPMENT

4.1 PRACTICAL RESEARCH AND A SIMULATION STUDY ON MANAGING PUBLIC PROCUREMENT CONTRACTS AND ASSESSING RISKS IN THE PROCUREMENT OF INDUSTRIAL EQUIPMENT

4.1.1 Establishing the general procurement framework and setting performance objectives

A. The main data related to the preparation of the award procedure

- contracting authority: Ministry XX, through the public institution LOGIST;
- object of purchase: "Forklift for material handling" - 10 EA;
- CPV code: 42415110-2;
- applicable legislation: Law 98/2016 on public procurement (* updated), together with the Methodological Norms for implementation, approved by H.G. 395/2016;
- legal approvals: the procurement disposition, the approved budget;
- estimated value of the contract: 800,000 lei, VAT not-included (1 RO leu≈0.2 EURO);
- source of funding: state budget;
- procurement procedure: open tender;
- evaluation factors: price (weight 80%), fuel consumption (weight 10%), additional guarantee (weight 5%) and noise level inside the cab (weight 5%);
- the estimated start/end period of the procedure: 07/01/2019 to 11/25/2019;
- input data: SAAP, PAAP, approved budget, the Requirements Package;
- output data: Award Documentation, contract, the Reception Form;
- the process: according to the relevant legislation and in compliance with the procedure timeline provided by ANAP [181].

B. Performance indicators associated with the award procedure

In order to evaluate the performance of the procurement process, regarding the planning and development of the award procedure, LOGIST defines the following process performance indicators:

- **PPI1: Delay in the procurement planning stage - days.** The contracting authority must meet the deadline, according to the estimated procedure timeline (table 4.1).

Table 4.1 PPI1 Number of days late in procurement planning stage

INDICATOR	<i>Outstanding</i>	<i>Very good</i>	<i>Good</i>	<i>Satisfactory</i>	<i>Unsatisfactory</i>
<i>PPI1 Number of late days in procurement planning stage</i>	0 days	1-3 days	4-7 days	8-12 days	> 12 days

A maximum of 12 days delay is allowed in the procurement planning by referencing the estimated procedure timeline.

PPI4: Number of bidders

To ensure high competitiveness, it is recommended that the tender be conducted with a minimum of three bidders. The procedure is also performed if there is only one bidder, but the probability of obtaining "value for money" is reduced accordingly (Table 4.4).

Table 4.4 PPI4 Number of bidders

INDICATOR	Outstanding	Very good	Good	Satisfactory	Unsatisfactory
PPI4 Number of bidders	> 3	3	2	1	0

If there are no bidders, the procedure will be canceled, and the grade associated with the performance indicator is *unsatisfactory*. The contracting authority will analyze whether there are any restrictive requirements in the *Terms of Reference/Scope of Work/Award documents* or whether the estimated price has addressed an unsuitable market.

C. Performance indicators associated with the contract

The contract performance analysis is conducted based on the following performance indicators:

- PPI7: The quantity of delivered products

The supplier must deliver the products in the established quantity, together with accessories, within the term agreed by the contract. If by the set date he has delivered the products in quantities reduced in relation to those assumed by the contract, the grades obtained will be those in table 4.7.

Table 4.7 PPI7: Number of products

INDICATOR	Outstanding	Very good	Good	Satisfactory	Unsatisfactory
PPI7 Number of products	10	9	8	7	<7

D. Performance indicators associated with the product

To evaluate the performance of the delivered product, LOGIST defines the following performance indicators:

- PPI6: Number of non-compliant products

Only compliant products are accepted at the reception, without manufacturing defects, and which have the quality level assumed by the supplier through the technical proposal. Non-compliant products are returned to the supplier to remedy the nonconformity or replace the product with a new one. Indicator *PPI6: The number of non-compliant products* uses the values in Table 4.16 as a reference.

Tabelul 4.16 PPI6: Number of non-compliant products

INDICATOR	Outstanding	Very good	Good	Satisfactory	Unsatisfactory
PPI6 Number of non-compliant products	0	1	2	3	> 3

The outstanding rating is obtained only if all the delivered products comply and meet the expectations of the contracting authority.

E. Performance indicators associated with management

Proper allocation of responsibilities, efficient communication within the institution, efficient management of resources, and the ability to select the best risk management strategies are just some of the objectives that define efficient management. For this purpose, LOGIST uses the following performance indicators:

- PPI21: Other activities carried out at the same time

The procurement responsible, the members of the Evaluation Committee or members of the reception committee, the contract manager, and other persons with specific

responsibilities must carry out their activity in the best possible conditions, without being stressed by time or engaged in other activities.

Table 4.21 PPI21 Engaging personnel in other activities

INDICATOR	Outstanding	Unsatisfactory
PPI21 Engaging personnel in other activities	NO	YES

The evaluation must be performed objectively, considering all difficulties encountered during the organization and conduct of the procedure and execution of the contract, delays, lack of concentration of staff, superficial fulfillment of responsibilities, or frequent delegation of tasks.

- PPI23: Number of risk assessment sessions

Effective risk management in procurement depends on the involvement of all employees as well as stakeholders. Risk assessment meetings will be established, during which risk management measures will also be established.

Table 4.23 PPI23 Number of risk assessment sessions

INDICATOR	Outstanding	Very good	Good	Satisfactory	Unsatisfactory
PPI23 Number of risk assessment sessions	> 9	8-9	5-7	1-4	0

Meetings are held both at planned intervals, during the three successive stages of the procurement process, and unplanned, when the responsible factors motivate the need to set up a working group to analyze the identified risks.

F. Resources

G. Documents

H. Justification for the purchase

The logistics structures within the Ministry use, to handle the materials in the warehouses, ten forklifts with a capacity of up to 2.5 tons, with an exceeded service life (over eight years) and with a very low degree of availability.

Therefore, the cost-benefit rate and the expected value of the investment are calculated to optimize the decision to extend the forklifts' life or start a procedure for the purchase of equipment with similar performance [29].

The technical-economic data used in the analysis are obtained from the market study [219] - [223]. The costs and benefits resulting from the procurement procedure are presented in Table 4.25.

For each day a forklift is inoperable, the institution must rent similar equipment. The downtime is more extended for old equipment due to the unavailability of spare parts and the limited market of repair service providers. Considering a rental rate of 44 lei/hour (resulting from the market study - [154]), the estimated costs for a period of immobilization of the forklift of 14 days/year are:

$$C_{unavailability} = \text{price/hour} * \text{no. hours/day} * \text{no. days} * \text{no. years} = 44 * 6 * 14 * 8 = 63.360 \text{ lei}$$

Analyzing the data presented in table 4.25, following the simultaneous application of the two methods of risk analysis, namely *benefit-cost ratio* and *expected value analysis*, it is found that the benefit-cost rate of the investment budget is 2.07 (a supra-unit value), so a new batch of forklifts should be bought (a profit of 1.07 lei for every 1 lei invested).

Tabelul 4.25 Using economics indicators to justify the purchasing (author proposal)

	<i>Investment values</i>	<i>Risk prob.</i>	<i>Expected value of risk</i>	<i>Expected value of the investment</i>
<i>Costs:</i>				
● Estimated value of forklifts	10 * 80.000 lei	0,1	80.000 lei	880.000 lei
● Personnel costs	30.000 lei	0,2	6.000 lei	36.000 lei
● Operator training costs - included	0 lei	0,1	0 lei	0 lei
TOTAL	830.000 lei			916.000 lei
<i>Benefits:</i>				
● Economy of operating costs	10 * 96.000 lei	0,2	192.000 lei	768.000 lei
● Cost savings of equipment unavailability	10 * 63.360 lei	0,2	126.720 lei	506.880 lei
● Economy of maintenance costs	10 * 2.720 lei	0,3	8.160 lei	19.040 lei
● Savings obtained from selling the old equipment	10 * 10.000 lei	0,1	10.000 lei	90.000 lei
TOTAL	1.720.800 lei			1.383.920 lei
Benefit-cost ratio	2,07			1,51

Also, the benefit-cost ratio for the budget that is subject to risk has a supra-unit value (a profit of 0.51 lei is obtained for each lei invested), which means that the decision on starting the acquisition is an appropriate one, even in risky conditions.

4.1.2 Assessment of the risks associated with the procurement process and the object of the contract

A. Understanding stakeholder expectations

- **SWOT analysis of internal factors** affecting LOGIST activity;
- **PEST analysis of external factors** affecting LOGIST activity;
- **RAPID assessment of stakeholder influence.**

B. Elaboration of the procedure timeline

The procedure timeline is elaborated according to the instructions provided by the Public Procurement Guide - [www.achizitiipublice.gov.ro/Procurement_process/ Process planning and Preparation/ Evaluation of necessity / Setting the timeline.](http://www.achizitiipublice.gov.ro/Procurement_process/Process_planning_and_Preparation/Evaluation_of_necessity/Setting_the_timeline)

In parallel, the correspondence with the Gantt charts obtained from the application of the scenario analysis (**Appendices V-VII**) is verified.

C. Identifying the factors that may influence the outcome of the procedure and assessing the risks associated with the procurement process and the object of the contract

Factors that may influence the outcome of the procedure, the vulnerabilities and risks associated with the procurement process, and the object of the contract are determined by applying the following techniques and methods:

- **RAPID assessment of stakeholder influence;**
- **STEEPLE analysis** of the factors that may influence the procedure;
- **questionnaire** to identify the vulnerabilities in the planning phase (**Appendix VIII**);
- **root cause analysis** - for the factors that influence the procedure timeline;
- identification of **risks in terms of ethics;**
- examination of **Activity Journals;**
- **Risk Register** examination (of the institution and of the procurement department);

- **brainstorming with the stakeholders;**
- **identification and analysis of risks in the procedural stages (Appendices II-IV);**
- **elaboration of a tree diagram** to justify the acquisition;
- **application of the scenario technique and elaboration of Gantt charts** - in the optimistic, the pessimistic and in the expected version (**Appendices V-VII**);
- **elaboration of tree diagrams** for the identification of the main causes of:
 - delivery delays;
 - delivery of non-compliant products;
 - inefficiency of the procurement process due to human resources.

4.1.3 Contract management and contract reporting activities

A. Administrative activities of the contracting authority

B. Managing the relationship between the contracting authority and the supplier

C. Contract performance assessment

The results of the performance evaluation of the contract are recorded and used for the issuance of the the *Confirmation Document* related to the contract, which contains information on the fulfillment / non-fulfillment by the supplier of the contractual obligations.

4.1.4 Organizing and carrying out the procedure

A. Publication of the award documentation in SEAP and waiting for validation by ANAP

B. Evaluation of bids

On the date set for the opening of bids, the contracting authority stated:

- Six bidders entered the competition. Next, they will be referred to as bidder AA, bidder BB, bidder CC, bidder DD, bidder EE, and bidder FF.

The scores obtained by each bidder are calculated using the weighted average method, according to the relations 3.2-3.5. The values are presented in Table 4.27.

Table 4.27 Evaluation of financial proposals (author contribution)

Bidder	Evaluation factors								Total score
	Price	Price weight	Consumption	Consumption weight	Warranty	Warranty level	Noise	Noise weight	
<i>Bidder AA</i>	79890	75,10	3,0	9,33	2	3,33	79	4,81	92,58
<i>Bidder BB</i>	77200	77,72	2,8	10	3	5	77	4,94	97,66
<i>Bidder CC</i>	76950	80	3,2	8,75	2	3,33	80	4,75	96,83
<i>Bidder FF</i>	78565	76,37	3,0	9,33	3	5	76	5	95,70

By applying the award criterion, **Bidder BB** was declared the winner, whose bid is 772,000.00 lei (VAT not included), and the total score obtained for the four evaluation factors (price, fuel consumption, warranty, and noise level) is maximum. On the 29th day after signing the contract, the supplier delivers 8 of the 10 forklifts, which are subjected to acceptance tests, after the training of the operators has taken place. Upon receipt, the products are *accepted*. On the 35th day, two more products are delivered, which will be accepted. The contract is finalized on 11/25/2019.

4.1.5 Analysis and evaluation of public procurement results

The performance of the procurement process is determined based on the results obtained for the 24 indicators set out in Tables 4.1-4.24, grouped into four sections, as follows:

- performance indicators associated with the award procedure:

A five-step scale is used: Outstanding (5p), Very Good (4p), Good (3p), Satisfactory (2p) and Unsatisfactory (1p). The results are presented in table 4.28.

Table 4.28 Results for performance indicators (author contribution)

Performance indicator	Results	Grades	Score (1...5)
PPI1 Number of days late in procurement planning stage	2 days	Very good	4
PPI2 ANAP decision: published	Yes	Outstanding	5
PPI3 Number of requests for clarification from bidders	No requests	Outstanding	5
PPI4 Number of bidders	6 bidders	Outstanding	5
PPI5 Number of technically non-compliant or unacceptable bids	1 bid	Very good	4
PPI6 Number of appeals from unsuccessful bidders	No appeals	Outstanding	5

The results obtained by LOGIST for the six indicators associated with the procedure are represented graphically in figure 4.1.

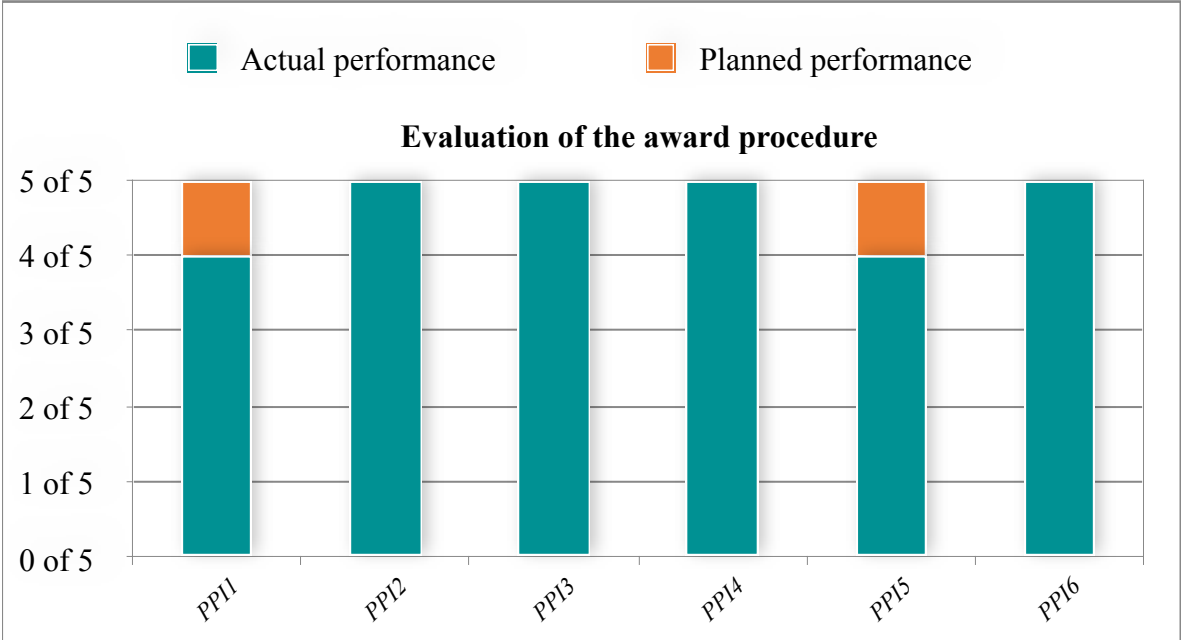


Fig. 4.1 Performance indicators associated with the PROCEDURE (author contribution)

The score obtained by summing up the six indicators provides a clear picture of how the contracting authority planned and conducted the award procedure. A scale with five ratings is used (figure 4.2).



Fig. 4.2 The evaluation of the procedure performance (author contribution)

The performance of the procurement process, in terms of planning and conducting the award procedure, evaluation of bids, and conclusion of the contract, is at a **very good** level. The contracting authority correctly planned all activities and allocated resources accordingly; the terms of reference were well-founded. The staff responsible for procurement and the evaluation committee members performed their tasks responsibly.

- performance indicators associated with the contract
- performance indicators associated with the product
- performance indicators associated with management

The performance of the procurement process, analyzed in terms of the four categories of indicators (associated with the procedure, contract, product, and management), is at a **very good** level (figure 4.10).

From a quantitative point of view, the score obtained from the application of the arithmetic mean for the 24 indicators is: $(28 + 39 + 18 + 21) / 24 = 4,42$.



Fig. 4.10 The evaluation of the procurement performance (author contribution)

It can be concluded that the **contracting authority LOGIST has met its established performance objectives** and purchased quality products delivered as expected and in the most advantageous conditions. The comparative representation of the procedure timeline in the estimated / actual version is presented in **Appendix IX**.

4.2 CONTRIBUTIONS ON IMPROVING THE PROCUREMENT PROCESS BY DEVELOPING AN IT APPLICATION FOR RESOURCE MANAGEMENT AND PROCUREMENT SUPPORT

4.2.1 RSAP platform interface and main functions

The applied approach of the topic is focused on the development of the graphical interface of a computer application whose primary function is to **identify and assess risks** in the planning stage of the procurement process, during the procedure and contract execution while having additional functions such as **evaluating procurement performance, sharing information** on purchased goods, available funds, ongoing or completed procurement, as well as providing models of documents helpful in carrying out procurement procedures [70].

The benefits of *implementing an integrated quality-risk management system* in the procurement structures of the Ministry of National Defense by developing an IT application for managing material resources and support for contracting authorities were addressed at the Conference "Security and Defense between History, Theory and Public Policy"- Defense Resources Management Section, organized by the Defense Staff.

The developed application is presented as a common platform at the level of public institutions with similar specifics - named **RSAP (Resources and Support in Acquisition Process)**, whose interface is represented in Figure 4.11 [70]. The platform allows access to a database containing information on fixed assets and other tangible assets (especially those with a high level of complexity) purchased in recent years by the contracting authorities registered in the system.

The database contains details related to the availability of products from the moment of entry in the accounting until its last update (defects and their leading causes, number of warranty interventions, availability coefficient, fall rate), technical documentation (operator manual, spare parts catalogs) and procurement documents (*Terms of Reference/Scope of Work*, approved technical proposal or supply contract). Beneficiaries may be contacted for further details that may be used to develop technical specifications or to establish contractual conditions (specific installation requirements, operator training, permits, specific transport and storage requirements).

Fixed assets are listed in the same order as in the Fixed Assets Catalog [174], so they are easy to select. There is also the option to identify them by name or the CPV code based on which they were purchased (Figure 4.12).



Fig. 4.12 RSAP platform interface - RSAP database (author proposal [70])

Another feature of the platform is to establish a comprehensive set of templates for acquisition and technical specifications, contracts, acceptance reports, contract performance evaluation reports, or procedure timelines - in the planned/completed version, documents proving their usefulness if they were developed under the conditions of Law 98/2016 [70].

At the same time, users can access the Risk Registers and Activity Logs of all contracting authorities registered in the system, which contain information such as the causes of cancellation of procurement procedures, complaints submitted by bidders, lists of suppliers who have not fulfilled their contractual obligations, rejected products at the reception [70].

Another function of the platform is *remote communication*, in real-time or via offline messages, through which ideas or information are exchanged between the applicant and other members registered on the platform, being a valuable tool in identifying and assessing risks in the procurement planning, during the organization of the procedure and the conclusion of the contract or throughout the activities of analyzing the performance of the procurement process (figure 4.14).

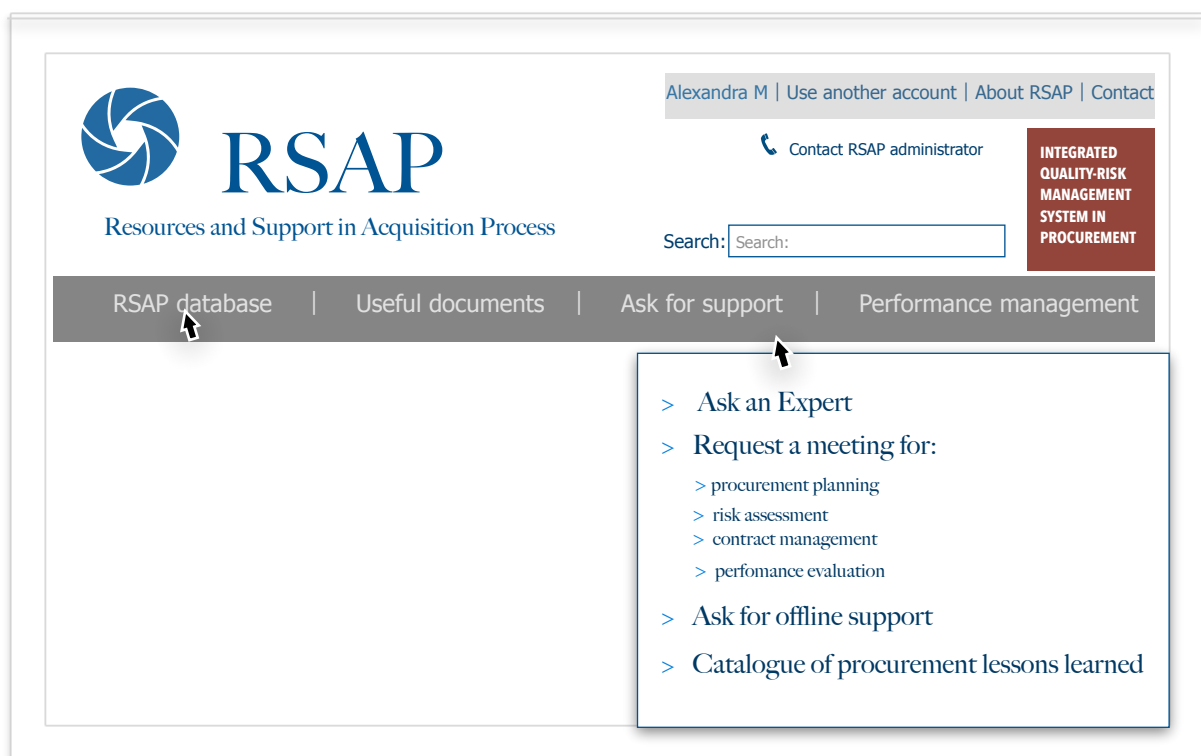


Fig. 4.14 RSAP platform interface - *Procurement support* (author proposal [70])

Each contracting authority registered in the system receives a score, depending on the performance of the procedures carried out and the activities conducted within the platform, as well as the feedback received from the members, following the guidance offered.

Thus, RSAP members are classified into three levels: *Entry-Level*, *Intermediate*, and *Expert*. The highest, the Expert degree, benefits from some facilities such as participating in teambuilding and meetings between members with the same rank or participating in videoconferences organized by the RSAP administrator, these privileges being kept only under active participation in the platform [70].

One of the essential functions of the platform is *performance management*. Thus, following the specialized evaluation of an award procedure carried out by a contracting authority, it will be highlighted the vulnerabilities of the system and the significant deficiencies of the management process, the difficulties encountered during the administration of the contract, as well as the main constraints related to human resources [70].

The function also enables sharing of lessons learned and identifying ways to improve the performance of the procurement to be considered in future projects. Positive results are also revealed through examples of successful procurement, good practices in contract management, or contracting authorities that manage risks very well.

4.2.2 Contributions regarding the application of the *Brainstorming technique* for risk assessment and for the procurement performance analysis

The RSAP platform allows organizing **brainstorming** sessions through an online video conferencing system. Taking into account the procurement of the 10 forklifts, the process takes place according to the following sequence [70]:

- LOGIST procurement representative requests support from RSAP administrator to organize an online meeting, to identify risks that influence the procedure timeline, for the acquisition planned to take place in the current budget year;
- the RSAP administrator analyzes the request and verifies in the database the existence of information about the contracting authorities that carried out procurement procedures for similar products while checking the available Expert level members;
- the applicant may choose from the available contracting authorities or may request to the RSAP administrator to schedule a meeting at a later date;
- each participant can take part into discussion, providing answers or plausible information, collected following similar procedures or using specific information gathered from the case libraries provided by ANAP.

4.2.3 Contributions on the application of the *Delphi technique* for risk assessment and for the procurement performance analysis

The RSAP platform allows online meetings based on a system of questionnaires sent individually by the RSAP administrator to each member of the working group or Expert level members.

The benefits of information exchange derive both from providing assistance based on good practices applied in other procedures that have had good results, from similar experience, or specific information, but especially from adopting proactive management focused on quality and risk and using all available resources to achieve the objectives [70].

4.3 STUDY ON APPROACHING PROCUREMENT AS A PROJECT AND USING MONTE CARLO METHOD TO SIMULATE THE PROCUREMENT TIMELINE UNDER RISK AND UNCERTAINTY

One of the most common Monte Carlo simulation software applications used at a global scale is ModelRisk - developed by Vose Software and which offers examples of graphical models in Excel, easy to understand and with extended applicability [191].

The main activities are identified, together with their duration (no. Days) - in the expected version, in the optimistic scenario, as well as in the pessimistic scenario.

The project risk analysis by Monte Carlo simulation uses as input the matrix of the procedure timeline provided by ANAP and information expressed in the form of lessons learned, collected through the RSAP platform, or results from own procurement procedures.

The probability of occurrence for an event that influences the timing of the procedure is variable. Hence, the mathematical model uses the values assigned to the duration of each activity (in the optimal version, the expected scenario and the pessimistic one) and successively calculates the triangular distribution for each activity, which by summation represents the total estimated duration of the project, namely the number of days required to complete the procurement procedure.

Considering the case of delivery delays, and accepting a probability of 20% (which can not exceed 30 days from the contract date). The algorithm is represented in Figure 4.22.

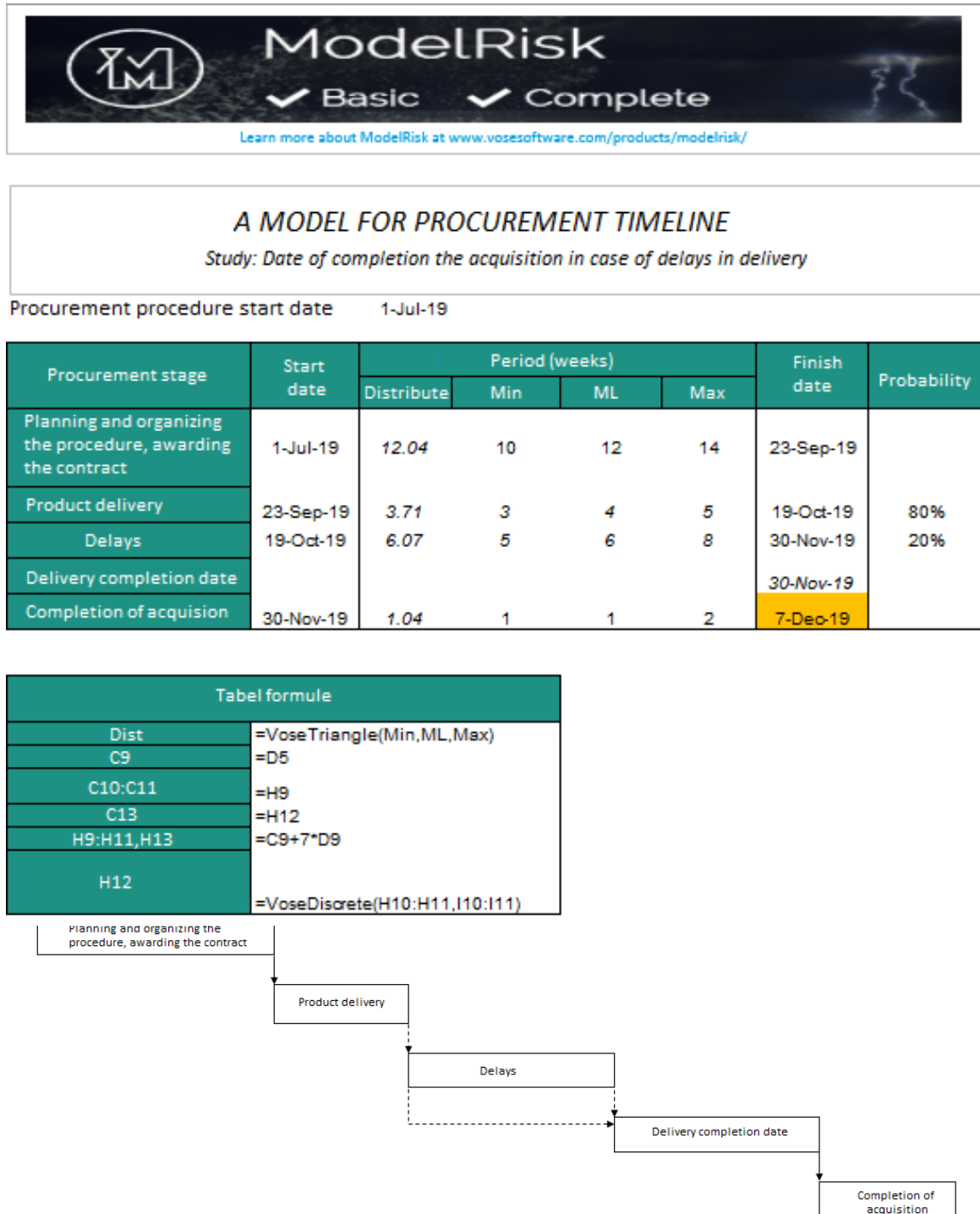


Fig. 4.22 Monte Carlo simulation to estimate the end date of the purchase in case of delays in delivery (author's contribution based on the graphic model provided by [191])

Running the program, it will be obtained the histogram from figure 4.23.

In this case, there is a 4% chance to complete the procurement procedure before 10/19/2019. However, unquestionably, the procurement will be completed after 12/15/2019.

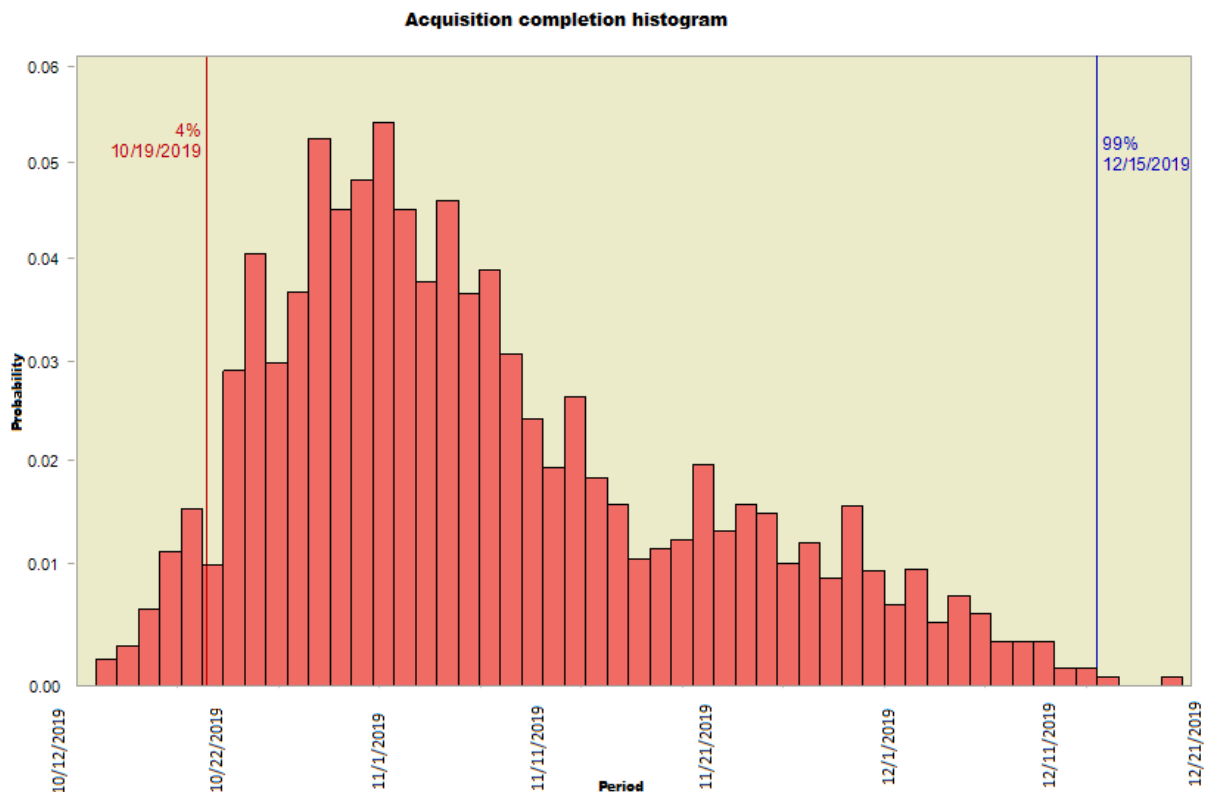


Fig. 4.23 Histogram of the procurement procedure in conditions of risk of delays in delivery (author's contribution based on the graphic model provided by [191])

The histograms presented are the most representative examples of how the risks may affect the evolution of the procedure schedule. The person in charge of the procurement can perform multiple iterations. The charts can be updated at any time, both during the procurement planning and in the organization stage of the procedure, and later - in the contract execution stage or to estimate the delivery time of the products.

The Monte Carlo simulation method can have wide applicability in procurement because it allows representing any influence on the procedure timeline and because the software applications that perform the simulations are accessible and easy to use.

4.4 THE DEVELOPMENT OF THE PROCUREMENT PERFORMANCE EVALUATION FUNCTION AND THE LEVEL OF ACHIEVEMENT OF OBJECTIVES BASED ON THE SATISFACTION EVALUATION QUESTIONNAIRES

The purpose of the questionnaire presented below is to *evaluate the procurement performance* from a neutral perspective, that of RSAP Expert members.

In this regard, a meeting will be set up attended exclusively by RSAP members of Expert rank (without LOGIST, beneficiaries, members of the commissions), and based on the results obtained and existing in the system (which, together with documents associated, were previously uploaded), will analyze the results obtained by LOGIST regarding the planning and managing of the procedure [70].

Expert members have extensive experience and an excellent overview, so that they have no difficulty in designing in mind the whole picture of the procedure the constraints and the risks to which LOGIST was exposed, as well as the efficient strategies for their management.

The next step is the development of an electronic questionnaire containing particular questions, which will be applied individually and completed online so that the results are returned instantly.

The questions of the survey and the related answers are [70]:

Question no. 11: Do you think that the contracting authority has correctly assessed the performance of the contract? (Table 4.42)

1. Yes, the evaluation of the performance of the contract was carried out, taking into account reliable quality indicators.
2. The performance of the contract has been evaluated, but the quality indicators chosen do not provide information to support the contracting authority in the following procurement.
3. The contracting authority did not express an interest in assessing the performance of the contract.

Table 4.42 Ability to evaluate contract performance (author's proposal)

Yes, the evaluation of the performance of the contract was carried out, taking into account reliable quality indicators	92 %
The performance of the contract has been evaluated, but the quality indicators chosen do not provide information to support the contracting authority in the following procurement	6 %
The contracting authority did not express an interest in assessing the performance of the contract	2 %

ANAP provides a series of template contracts, forms, or documents, issues instructions, and offers recommendations but does not issue views on the outcome of the procedure or the performance of the procurement, the contracting authority being the only entity capable of analyzing the relationship between the object of the contract - its management capacity, setting performance indicators, assessing risks and taking effective measures to manage them, evaluating the procurement performance, and taking action to improve it.

In this case, the RSAP experts consider that the contracting authority has a very high capacity to perform a correct self-assessment of the results, considering valid information viewed from an objective perspective (Figure 4.34).

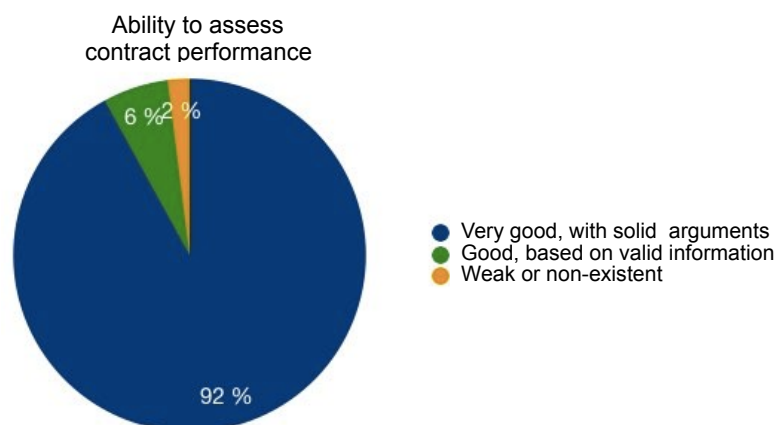


Fig. 4.34 Ability to assess contract performance (author proposal)

If LOGIST does not agree with the results of the evaluation, he has the possibility to request a meeting with the Expert members who evaluated the acquisition, at a mutually agreed date, in which specialists will support their answers and provide advice to improve the activity, so that in carrying out the new award procedures LOGIST to take into account the advice received, thus being one step closer to meeting performance objectives.

4.5 RECOMMENDATIONS TO INCREASE THE PERFORMANCE OF THE PUBLIC PROCUREMENT PROCESS BY IMPLEMENTING AN INTEGRATED QUALITY RISK MANAGEMENT SYSTEM

A detailed analysis of the public procurement system in Romania reveals a series of legislative or procedural limitations. The work procedures are outdated. There are few employees with skills and experience in procurement, but they are not motivated by salary or by career development perspectives. At the same time, managers of institutions are forced to seek permanent solutions to streamline the spending of allocated public funds.

In this context, the policies adopted by heads of institutions and project managers must not lack notions such as **quality orientation**, **value for money**, or **digitalization**, and **risk management** must exceed the level of a standard of managerial control and thus become a moral obligation of all employees.

The author conducted the study from a dual perspective, namely that of a public procurement specialist who is aware of system deficiencies and the effects of risk materialization on the outcome of an award procedure, but also that of a head of a department with functional responsibilities, which ensures the interface between economic operators and beneficiaries of purchased products so that the performance of the procurement process becomes quantifiable in terms of four primary indicators: *quality, quantity, time and cost* (Figure 4.35).

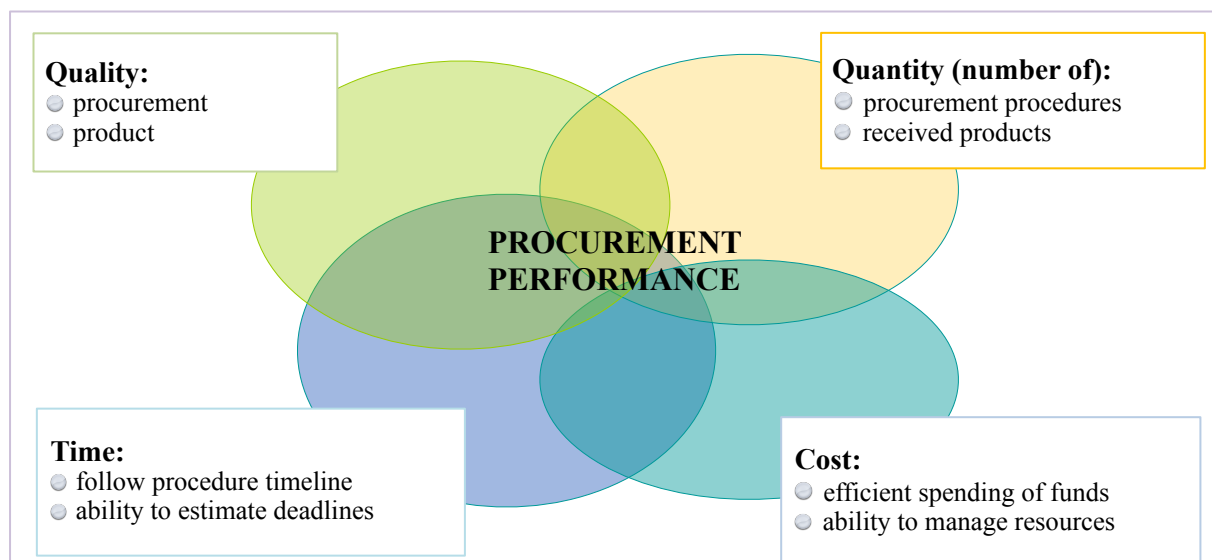


Fig. 4.35 Procurement performance (author proposal)

It is necessary to revitalize the public procurement system both through a *bottom-up* approach, by analyzing the problems at the level of each subsystem and identifying solutions for each problem, so that the system as a whole becomes efficient and a *top-down* one, by replacing procedures and modifying processes, using high-performance techniques and models with proven results in the private system, so that the measures produce significant effects at the level of each subsystem (figure 4.36).

Key performance indicators:

Estimated results

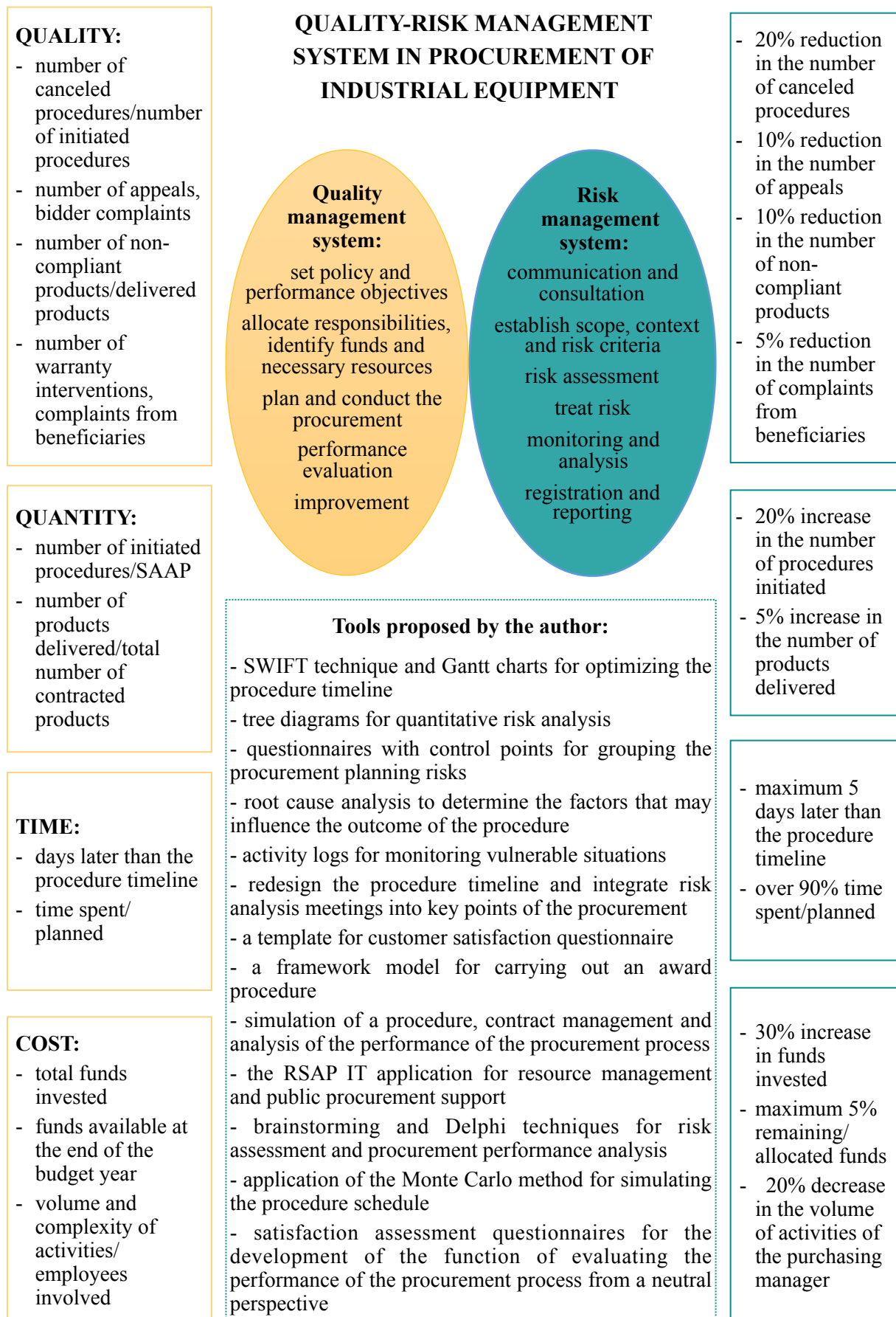


Fig. 4.36 Degree of the fulfillment of performance indicators associated with the procurement (author proposal)

CHAPTER 5

GENERAL CONCLUSIONS. PARTICULAR CONTRIBUTIONS. FUTURE DEVELOPMENTS AND APPLICATION OF RESEARCH RESULTS

5.1 GENERAL CONCLUSIONS

This doctoral thesis addresses a topical scientific field, namely **integrated quality-risk management in the procurement of industrial equipment**. The choice of theme is dictated by the need to overcome legislative barriers in procurement, through a systematic approach to quality and risk and their full integration into the management and organizational processes of public institutions, having as a primary goal the attainment of *value for money*, translated into efficient spending of public funds.

Theoretical researches and case studies conducted during the elaboration of the thesis allow the formulation of the following conclusions:

- the development of a quality-based culture involves, first and foremost, understanding the specialized terminology and classical methods of quality control and assurance, as well as modern quality improvement techniques, the main effort being focused on the **development, implementation, and improvement of a quality management system** according to the standards of the ISO 9000 family
- **each activity involves risks**, but given that public procurement involves the management of public funds, the risks involved are not only procedural but also ethical or in breach of the fundamental principles of public procurement;
- there is no standard risk management formula in procurement or a catalog containing all the factors that may influence the outcome of the procedure; it is the responsibility of managers and procurement specialists **to identify and assess risks, as well as to apply appropriate mitigation methods**;
- the right to health, education, or protection is guaranteed by law, and the role of public institutions is to ensure the availability of these services to citizens; the task of the procurement system is to ensure that the public funds are managed judiciously, **taking into account performance objectives and considering all associated risks**, so that quality services are provided, fully reflecting the care for citizens;
- **the implementation of an integrated quality-risk management system** in a public institution allows the optimization of the organizational framework for the procurement procedures, and through systematic quality planning and taking into account the risks that may affect the outcome of the procedure, there will be a real improvement in the management of public funds and the achievement of performance objectives.

5.2 PARTICULAR CONTRIBUTIONS

The results of the theoretical research and case studies carried out during the elaboration of this doctoral thesis allow the highlighting of the following personal contributions:

Theoretical contributions:

- critical analysis of the **current state of research on integrated quality-risk management** and synthesis of the main aspects related to its approach in procurement;

- the study of the conceptual **evolution of risk and the notion of risk management**, the relationship between risk and objectives, as well as some particularities regarding the application of modern risk assessment and management techniques;
- presentation of the general framework for implementing the **standards of Internal Control** and the processes of the risk management system in public institutions;
- **analysis of the public procurement in Romania**, with a focus on the evolution of public procurement legislation and principles, types of procedures, stages of procurement, and main associated risks;
- highlighting the relevant aspects regarding risk management in public procurement, elaborating the quality assurance requirements, and analyzing the opportunities regarding the **approach to the procurement process from the perspective of integrated quality-risk management**;
- carrying out the PEST and SWOT analysis to **identify the internal and external factors** that influence the process of purchasing industrial equipment, as well as highlighting some particularities regarding **risk management in terms of ethics**;
- elaboration of a theoretical study on the **efficiency of procurement planning** through qualitative and quantitative analysis of risks, grouping them based on questionnaires with control points and optimization of the decision-making process, taking into account the risks that affect the achievement of procurement objectives;
- conducting the **root-cause analysis** to determine the main factors that may influence the outcome of the procedure and proposing a model for monitoring vulnerable situations;
- conducting a study on the **design, implementation, and improvement of the integrated quality-risk management system** in a public institution with procurement competencies and **developing a framework model for conducting a procedure** for the procurement of industrial equipment.

Applicative contributions:

- **conducting simulated applied research, in a particular form**, on the management of public procurement contracts and risk management in carrying out an award procedure for industrial equipment;
- **developing the graphical interface of an IT application** for contracting authorities, which can be used in planning, analyzing, and improving the procurement;
- conducting a study on the procurement approach as a project and **applying the Monte Carlo method to simulate the procedure timeline in risk conditions**
- developing the function of evaluating the performance of the procurement process and the level of fulfillment of the objectives based on the **satisfaction evaluation questionnaires**.

5.3 DEVELOPMENT PERSPECTIVES

The theoretical results and case studies carried out in the present doctoral thesis may highlight, in the future, *the necessity for future developments in the following directions:*

- designing, implementing, and establishing measures to improve **an integrated quality-risk management system** in procurement;
- the use of **modern techniques for identifying and assessing risks in the procurement planning stage**, during the procedure, and as a contract performance management tool;

- developing a **quality-risk management information system in procurement**, starting from the basic model and functions of the proposed IT application for resource management and support for public procurement;
- proceeding studies on **the use of Monte Carlo simulation** and modern risk assessment techniques, as well as their extensive implementation, in order to optimize decision-making and efficient management of public funds;
- increasing the awareness of managers and procurement specialists about the importance of a management approach based on quality and risk, by **conducting specialized training sessions** or by **developing dedicated guides and instructions**;
- elaborating a strategy and an action plan to develop the function of evaluating the performance of the procurement by establishing a system of **indicators of the efficiency of quality-risk management in the procurement process**.

5.4 A SYNOPSIS OF RESEARCH RESULTS

The results of the research carried out during the elaboration and completion of the doctoral thesis were capitalized as follows:

- **publishing, as sole author, respectively first author**, two articles in the journal „Quality - access to succes”, ISSN 1582-2559, in 2017-2018:
 - **Marian, A.I.**, *Some aspects of Supply Chain Risk Management. Global Risks Map and Apple’s Approach to Risk Management*, vol. 18, no. 160, p. 64-68, Oct. 2017;
 - **Marian, A.I.**, Militaru, C., *Quality Assurance in the Procurement of Products destined for the Romanian Ministry of Defense*, vol. 19, no. 163, p.122-126, Apr.2018;
- **participation in the international scientific conference** “Security and Defence between History, Theory and Public Policies”, 1st Ed., Section *Defence Resources Management*, organised by the Defence Staff, Bucharest, National Military Circle, 6-7 November 2019, with: *Improving performance and risk management in procurement by developing a common platform at the Ministry of National Defence* followed by their publishing in „Romanian Military Thinking”, 2019 Special Issue 4, p. 536-549, *Online ISSN:2668-8115*;Romanian Military Thinking.
- **publication, as sole author**, in ”Romanian Journal of Automotive Engineering – RoJAE”, **Marian, A.I.**, (en) *A framework for risk management in the public sector for keeping vehicles in good operating condition*, Vol. 25, No. 4, 4th Series, p. 113-121, December 2019; *Online ISSN: 2457-5275*;
- **publishing, as sole author**, an article in the „International Journal for Research in Applied Science & Engineering Technology”, *Online ISSN: 2321-9653*:
 - **Marian, A.I.**, *Towards Efficient Public Procurement in Romania: A Practical Risk Management Approach*, Vol. 8, Issue VII, July 2020;
- **publishing, as first author**, an article in the international journal „American Scientific Research Journal for Engineering, Technology, and Sciences”, *Online ISSN: 2313-4402*:
 - **Marian A.I.**, Soare, E.I.M., *The Benefits of an Integrated Supply Chain Quality Management*, Vol.17, No.1, p. 212-219, August 2020.

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