

SUMMARY

With the intensification of globalization and the expansion of global markets, companies have to face increasing competition. Therefore, they have begun to offer various advantages, such as customizing products for potential customers. However, market conditions and implemented legal policies can generate challenges in the potential to predict whether these benefits can be offered or not. In addition, project managers are in a position to meet specific requirements, especially at the level of changing factors that make it difficult to manage tasks. All these circumstances generate the complexity that managers do not know has created problems in a particular project. They also do not know fully the fact that traditional standards of project management provide not sufficient support in managing complex projects.

The literature highlights the fact that in the past, project management was much easier than it is today. The main goal of project management is the predictability of project results and the ability to reproduce those projects that have proven to be "good practices". Current projects are developed in a more difficult environment and are much more influenced by factors subject to rapid change. Increased complexity highlights an efficient project planning where managers have continuously considered their knowledge and the state of complexity. To steadily achieve project success, management should be verified and, if necessary, supplemented with complementary tools to identify and eliminate complexity.

From this perspective, the research presented in this thesis was designed to combine the non-standardized complexity with the standardized project management to identify a viable option in terms of applicability. This research investigates how current project management standards address complexity and also points to the need to create a new standard or specific tool, investigating complexity enhancers.

In addition, change factors have been examined in the context of specialized literature addressing complexity and investigating the origin, impact and complexity management. It has also been essential to investigate how complex projects can be properly implemented. The study of the specialized literature led to the creation of five research areas. Attempts to answer research questions through surveys and focus group interviews of experts in project management. Project management and project management elements complexity are combined and investigated, and this synthesis was done using both qualitative and quantitative research. Therefore, "enhancers / facilitators" complexity have been reviewed to find out where and how it could impact the implementation and enforcement process stages of a project. Thus, it was taken into account that there are different management approaches for managing complex projects. In order to analyze the influence of the intensifiers on the project management processes, the current prevailing standards have been approached, and based on the research results, a specific model has been developed whose purpose was to support managers in their daily practice and complexity classification of their own projects. From this perspective, it was attempted to synthesize the overall complexity of complexity and the linear image specific to project management standards, and for the first time, through a model, the correlation between complexity intensifiers, vulnerable processes, the scope of projects on the coordinate chart (size, complexity). Nowhere in the literature, a similar approach has been identified, but only sporadic occurrences of the idea of creating a model for approaching complexity. Based on this model, managers should be able to identify the real intensifiers of complexity and those processes of their own projects, affected by complexity. Finally, a possible adaptation of standards has been made to the research, and a proposal for a new guide has been conceived that will support complex project managers.

research was based on application a mixed method, consisting of a survey (quantitative method) and focus group interviews (qualitative method) with project management experts in Romania. There are approximately 10,000 project managers in Romania, certified by different bodies, of which 1314 project managers were certified by internationally recognized bodies at the beginning of 2018 and 160 of them were surveyed (11.9%), and 110 (8.2%) answered all questionnaire questions. This one the situation is considered sufficient to provide reliable results in the

proposed research. In addition, interviews with focus groups have deepened their knowledge and validated the results of the survey and led to the conclusion of the research - complexity is a real problem in project management, existing standards are sufficient for project management, but complexity can not be standardized.

Finally, this thesis aims to generate a foundation to support project managers in solving problems of project complexity, by creating navigation guides in complex projects.

The first chapter, entitled **Journey in complexity**, made a presentation of the term of **complexity** and **complexity theory**, is also described **the origin of complexity, specific enhancers** and **root causes**, generators thereof. The **different forms of complexity** and **their impact on the value chain**, as well as the **processes of viewing** and **managing complexity through control, reduction or elimination** were presented. Finally, some **elements** have been introduced **regarding the complexity and the resulting costs**.

In the literature, definitions of complexity are different. Over the years, many authors have simplified and clarified the definition of complexity, especially with specific features: continuous - continually moving, increased complexity / opacity, spontaneity of the hierarchy, adaptation, large number of different elements, irreversible and constrained in manifestation of existing restrictions. Generally, from the perspective of these definitions, complexity refers to a multiparty entity, linked or connected, characterized by difficulty, obscurity and uncertainty. The first part of the argumentation is quite simple to understand and has been used by many researchers as a basis for defining, in particular, the complexity of the projects, while the second part, "complicated", often generates the question "*What is the difference between complicated complex?*". From the study we can see that all the identified elements support the creation of a point of view on **complex** and **complicated** terms, but do not give a definition with which the two concepts are clearly differentiated.

The term *complexity* is generally used to characterize a compounded or multi-part element disposed in a complicated manner. The simple meaning given in dictionaries is "the *quality or the condition of being complex*". Often the definitions of complexity are related to the system concept and are not univocal. A *system* is defined as a set of parts that interact or are interdependent and form an integrated assembly, which is to a certain extent similar to the definition of the term "*complex*", ie consisting of several different and connected parts. Many researchers frequently use the term "system" in conjunction with the term "complex", such as a complex or complicated system, where complex or complicated emphasizes the degree of interconnection. A complex system is the system of interconnected components, which as a whole is characterized by one or more specific elements not evidenced by the properties of the components.

The theory of complexity was also mentioned in the study of complex systems, computational complex theory, computational theory and organization, and complex economic sciences. Complex theory and organization has had a particular influence on strategic management and organizational studies, incorporating the study of complex adaptive systems.

Complexity has different types and influences a system in a variety of ways. ***The researcher analyzed complexity types as presented in many authors' works, identifying 42 complexity types, grouped by categories according to: environment, time, market, technology, organizational, production, process. These categories were then subdivided into objective / subjective and internal / external views.***

The fundamental causes, internal and external, of complexity influence current projects. Externally, market requirements influence projects because in a globalized market customers change their requirements as it changes. Internally, project and company processes are constantly changing, which will lead to a reduction in their development timeframe, due to the shorter product life and acceleration in the development of information technology. Internal and external influences on a product or organization affect the product / project through interfaces or the decision to produce / buy and modify the structure of the organization. All of these factors can generate complexity, especially when the initial planning of a project records changes.

Complexity intensifiers are mainly powered by interconnection, change and diversity. When all three features are combined and hold a high proportion in their entirety, they create a system of high complexity.

To identify complexity, system elements must be monitored, differentiated, described, evaluated and correlated with each other. From this perspective, only a few standards and monitoring tests provide unique insights. They focus on specific elements, reactions or topics and, moreover, still solve the problem of complexity through possible observations.

Finally, complexity management is a continuous act that identifies unexpected developments at each phase of a process. In order to maintain continuity, the complexity management component should also be included in the strategic management and level. A prerequisite for complexity management is the clear definition of roles, responsibilities, objectives and communication, as well as project management. The quality of the outcome of complexity management depends on resources and a concrete and clear data analysis, when the requirements are defined. In addition, performance variation must be taken into account, and throughout all procedures, the optimal level of the internal value chain must be achieved for an ideal structure in market orientation, mix of products, value creation and organization. Complexity control is accomplished by following a predefined sequence of steps: progressive planning, using lessons learned from previous projects, avalanche planning, and multiple estimation methods. Reducing complexity is possible by standardizing products, generated by modularization, optimizing assembly processes, scale effects, or reducing product / component variations.

Diversity is the complexity index. Diversity is the possible number of differentiable states of a system, so combinatorial elements justify diversity. The complexity assessment is mainly subjective and partly dependent on the observer's point of view. There is no confirmed and proven index for assessing complexity. In general, it depends on the observer and his attitude towards the system.

The scientific approach continues, in the second chapter, **Projects and project management - the perspectives of complexity and quality**, which presents, in an idealized way, the issues of projects and complexity, project management, critical success factors, project management from the perspective of complexity models, quality and complex project management issues.

The complexity of a project is rather a key area of research rather than the central element of this research, since analyzes of all other areas of research revolve around and evolve around it. That is why it is very important to have a thorough understanding of this phenomenon with complex facets, analyzing the different ways in which the researchers explained it and its implications for the project management practice. In the specialized literature dedicated to project management, the definition of *complexity of projects* varies, being represented from an individual perspective. In recent years, much has been discussed about the complexity of the projects and, despite everything written and said, more confusion than clarity has been created, because the complexity and complexity of the projects have been interpreted in different ways.

Project management is the planning, delegation, control, management and organization of a project to achieve a result, respecting the specific criteria, represented by the cost, time and agreed performance. Organizations are motivated to implement project management as they expect it to increase efficiency and reduce the risks of a project; At the same time, project management connects together different stakeholders. This improves the survival capacity in the global economy.

Also, critical success factors for project management led during the investigation by the incursions of many authors who have developed and published a list of factors, some related to a particular area and the activities associated with it, others apply to all types of projects. The purpose of the research on project success factors has been focused on identifying those critical areas that increase the likelihood of achieving a successful project outcome. Initially, the emphasis placed by researchers on critical success factors was on project control issues, but it turned out to be a limited approach as it only focused on developing standard tools and techniques for project management. The outcome of further studies, particularly on large projects, highlighted the importance of other factors that had to be considered in order to successfully manage their projects and results.

In many of the studies, work and research dedicated to project management, the role of quality in project management is still seen as a quality control, ie the design and implementation of procedures for inspecting inputs or outputs. The predominant attitude regarding the quality place in project management is exemplified by Turner 's (1993) who adapted Crosby 's phrase , *quality is free* in " *quality is free, but not in the life cycle of a project.*"

At the end of the chapter, the detailed image of complex project management finalizes the conceptualization and the theoretical substantiation of the thesis. Complex Project Management can be defined as the act of guiding and managing multiple unique initiatives with a well-defined starting point and end point. According to many researchers, practitioners and theorists, guiding and controlling all of a company's projects has gained increasing importance over the past few years. The basis for complex project management is identical to the initial definition of management. Like management, complex project management is also classified on three levels but is based on projects. In the field of management, the levels are: top management (strategic), medium level (tactical) management, and lower (operative) management. The same levels apply to complex project management: top management is the strategic approach to project portfolio management, mid-level management is the program management, and bottom-level management is project management. All three levels depend and benefit from the complex project management skills: resource planning, project optimization, process definition, procedures and professional skills development.

The third chapter, The **Methodology of Research** , presents in detail the philosophy, the approach, the research strategy and design as well as the methods used in approaching the research problem. Both the methodology and the research methods had to be presented and discussed, because the method and the methodology are completely different and interchangeable concepts. This chapter aims at clarifying the research philosophy, the specific approaches as well as the design and research strategy adopted. The overall goal is to present a well-grounded reasoning of selecting appropriate methods and methodology in the context of objectives, coverage area, and study limitations.

The study of the specialized literature led to the creation of five research areas. An attempt was made to respond to research questions through surveys and interviews of project-focused focus groups.

Research area I : the way in which complexity influences the course of project management

The research area II: identify "their enhancers / facilitators their" complexity of the project management

Research Area III : how project management influences complexity

The research area IV: identifying the UI application of any changes to the standards chosen specific project management, for managing complexity

The research area V: identification and other or complementary methods in addition to those mentioned in the standards of project management, the administration re antithrombin complex
In this chapter, specific project management, complexity and quality management research elements are identified, combined and investigated. This synthesis was carried out using qualitative and quantitative research theories. Therefore, all concepts of research, which are appropriate to the current one, have been reviewed to identify the most appropriate ones from the perspective of the stages of the process of implementing and implementing a project and its complexity. Thus, it was taken into account that there are different management approaches for managing complex projects. From this perspective, it was attempted to synthesize the overall set of concepts and theories. This study uses the approach of the mixed method that has been operationalized through the survey (quantitative method) and the interview (qualitative method). The quantitative principles have strongly influenced the design of the research, while the qualitative approach has provided in-depth knowledge and validated the results of the survey.

By taking into account the strengths and weaknesses of qualitative and quantitative approaches to current research was considered appropriate triangulation method, which referred to the use of multiple methods of data collection. Thus , the qualitative approach was used to explore practitioners' opinions and to understand the reasons behind their reasoning, while the quantitative approach was used to focus on certain areas and to investigate relationships and

/ or differences of opinion using techniques statistics. One of the main reasons for using this research method is to validate triangulation results because it is one of the ways to determine whether the results of different studies converge to common ground. As with justifying the use of both qualitative and quantitative approaches and inductive / deductive approaches, similar justification is valid. Different methods can be used for different purposes in a study, as in this research in which initial (inductive) interviews were conducted to identify key issues, followed by a questionnaire (deductive) to test hypotheses. From the temporal perspective, current research falls into the instant category / transversal study, one reason being time constraints, and the second is that this study does not focus on investigating a change but rather on obtaining an instantaneous observation and understanding that is the starting point for further research.

Prior to initiating the survey, a pilot test was carried out with a small group of project management experts. The pilot test aimed to identify the possible obstacles generated by the blurring of expressions or phrases, but also from the perspective of the importance of specific concepts in the research and the ability of the questionnaire to generate the results and information that are sufficient and necessary for the research and identification of the findings. After the pre-test, the revised and modified set of articles was ready to be tested by conducting a pilot study. The ideative course of the pilot study led to the identification of the answers to the questionnaire, accompanied by opinions expressed on various elements, **concepts and concepts of complexity , projects , complexity in projects , complexity of projects and factors contributing to the complexity of projects)** . It is worth noting that the main objective of the pilot study was to gain a pragmatic picture of the complexity of the projects and to identify the factors that contribute to their complexity. In addition, in order to substantiate and deepen the answers to the questionnaire, respondents were asked about the critical factors of success in the context of the complexity of the projects.

Current research continued with the adoption of the survey approach, including both semi-structured interviews conducted through the pilot study and the questionnaire. Because the nature of this research was focused on exploring current projects, understanding the context and developing it based on the views of practitioners in the field, semi-structured interviews were the appropriate approach, especially when it was important to know why the respondent gave a specific answer and to understand the attitudes and opinions behind the answer, developing and shaping the understanding of the respondent's world. The survey has been reviewed on the basis of the findings of the previous pilot test and study and the study of the literature, in order to test the research areas and order the impact levels of the complexity factors of the projects.

The questionnaire was divided into four different sets of questions, centered on complexity and management.

Set questions 1: project, project manager and quality - project-specific questions, project manager, and quality

Set Questions 2: complexity tools - questions specific to the influence and impact of complexity tools

Set Questions 3: Link between Complexity and Project Management Standards - Specific questions related to complexity management correlation with project management methods and standards

Set questions 4: vulnerabilities from the perspective of complexity - the vulnerabilities of project management from the perspective of complexity

In the second phase of the research , the method of interviewing with a target group, face to face, with project managers or members of certified or undergoing certification teams was adopted to understand the context of the projects, their complexity and management project in terms of complexity. The prospect of having follow-up questions has generated a higher level of confidence in the answers, as a clearer understanding of meaning and reason is achieved. In this research, interviews were suitable for the theme of study is correlated with polls that supported understanding of the problem in order to explore it in depth. Questions prepared from the guided interview helped the interviewer to avoid going over important topics and, moreover, comparability between different interviews was ensured because the

interviewees discussed similar questions, supporting the researcher in evaluating the results of the questionnaire. In addition, interviews with target groups added a thorough understanding by exploring the participants' practical experiences. The group of participants was reduced, depending on the specific skills as experts, the investigation being the opinion of similar groups relevant to the subject of the research, represented by the complexity from the perspective of project management.

The interview was initiated by going through three questions. The first question addressed the participants' interest in the topic " **To what extent are you interested in the topic of optimal treatment of complexity in project management?** " Responding to this question, participants emphasized the desire to engage actively in discussions, being encouraged to lean on complex projects. On this basis, the following two questions were built. " **Have you ever been involved in a complex project, either as a stakeholder, project manager or project team member?** " Responding to this question, the participants reflected on the experiences of being involved in complex projects. Generally, people initially recall the positive and negative effects resulting from a complex project. Based on this reflection process, the last transition question has been put to " **How did you behave in this situation?** ". Participants were encouraged to provide examples of how they treated different situations in complex projects, regardless of the awareness of specific methods of action.

After the creation of the ideal framework and the orientation of the participants towards complexity and complex project management, key questions were developed and presented.

Key Question 1: Do you agree with the enhancers / facilitators of complexity presented and administered by control or reduction?

The next key question was developed based on the results of key question 1 and a reflection on failed projects.

Key Question 2: Does a project's success depend on project managers and you, as a certified project manager, manage vulnerable processes using detailed working methods?

From the results of the online survey, a matrix was developed to identify the complexity of the projects. This matrix consists of three tables combining the following variables: complexity enhancers, the most vulnerable processes of a project, complexity, participants' classification of complexity in their own projects, size of projects and the scope of the project to be addressed by the participant. The matrix was developed based on the results of the online survey and was then evaluated by the target group from the perspective of practical application.

Key Question 3: From the perspective of your own complex project, do you find yourself in any of the situations contained in the Enhanced Enhancement Matrix and Vulnerable Processes in the Project? Compare the identified area of the project with the intensifiers and vulnerable processes of the project. Are there any similarities?

The last key question relates to the key question 2. The participants were questioned to explain the success of the projects as presented in the survey. In addition, key question 4 asks the participants to discuss whether project management standards effectively address complexity management, and whether an adaptation of these standards is required.

Key Question 4: How can a project management standard support a project management complexity? Is it necessary to create a separate chapter or explain the new complexity management methods?

The fourth chapter, **research results - discussion and analysis**, focused at research based on survey results, the developing country structure ii matrix is by which, the projects can be identified and managed complexity.

A the objective of this research was to create a structure to support the identification of specific complexity enhancers / facilitators and vulnerable processes at the level of each participant's project area. The originality of the research consisted of the fact that its structure and its components were made for the first time. Project management experts have issued estimates on the classification and level of complexity of the projects. This is because, on the one hand, project managers have different experiences, on the other hand, it is not possible to compare each project with an area of activity in which projects fall. The arrays presented the potential enhancers of complexity and vulnerable processes, grouped by project categories and levels

is made through a model. Nowhere in the literature, a similar approach has been identified, but only sporadic occurrences of the idea of creating a model for approaching complexity.

Continuing and to summarize, interviews and literature have highlighted the validity of existing standards of project management to manage complexity, complexity treating them satisfactorily.

The introduction of a separate separate chapter, dedicated to complexity, was considered necessary in the survey but was rejected by the results of the interview. It should not be integrated into the standards because the complexity approach can not be standardized, and any additional notices within the standards could cause confusion. It was obvious the common desire to create a separate project management guide. The elements to be covered are the confirmation and identification of complex projects (the second stage has been partially investigated in current research) which, in turn, should be included in this new guide. Such a guide will support and present ideas on the area that requires attention from a complex project, how to deal with the identified area, by addressing the whole process from confirming the existence of complexity, identifying the complexity of each process, methods and means management and resolution and a final assessment of progress. The guide can be based on five phases (training, assault, normalization, deployment, and ending) used for optimal approach to complexity in project management, by recognizing a complex project, identifying complexity in unique processes, possible approaches and assessing progress.