RISK PLANNING IN AVIATION SCIENTIFIC RESEARCH PROJECTS

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Abstract: *Aviation scientific research projects, a field recognized as one very risky, require an effective risk management system ever since the stage of proposal of the design and implementation capabilities. The paper does not propose to redefine specific steps of risk management projects process. Its main objective is to highlight the importance of simple approaches for successful decisions, even from the planning stage. The result of the research is the design based on a simple qualitative approach, an initial risk management plan for MASIM research project.*

Keywords: *risk planning, aviation project, risk management plan, MASIM*

1. INTRODUCTION

The projects are all interrelated activities which take place according to a plan in order to achieve certain results in a limited period of time [1]. For aviation projects, using knowledge, competencies, skills, tools and specific techniques has resulted in the development or improvement of airports, making electronic or mechanical, aircraft development and introduction of a new system for air traffic control or discovery of material with special properties.

The risk in research projects may take the form of total failure (expected results do not materialize) or partial failure (expected results outside the triangle to materialize in time - cost - quality) of the scientific initiative [2]. In this context, risk analysis systematically uses available information to determine how often events may occur (specific or nonspecific) and the magnitude of their impact on the project [3].

Promoting a risk culture plays an important role for the success of scientific research projects. In the team / research consortium this translates by highlighting the benefits of risk management activities, which are often perceived as useless and resource intensive [4]. Project competitions discourage the identification of risk through the design of funding applications, because they are perceived as weakness. Reality has shown that a good balance between funding and results of the project is achieved when there are viable action plans for achieving the objectives of risk management activities thus adding value to the project.

Project risk management attempts to anticipate and provide a solution regarding the uncertainties that pose a threat to project objectives and terms [5]. In aviation projects, small or complex, a risk management strategy should follow two main directions: to identify as many potential risks as possible and, then, to decide how to deal with them [6].

To achieve the objective, the first part of the paper addresses the positioning of research projects in aviation on the quality-time-cost diagram and the second part details the process of

risk management specific to the MASIM project, which results in the design of the original risk management plan.

2. RISK MANAGEMENT IN RESEARCH AND DEVELOPMENT PROJECTS

The risk of undesirable events in socio-technical processes exist and can not be completely eliminated. Accordingly, research and development projects should be conducted taking into account that there are always risks that require effective management throughout the lifecycle of the project and favorable circumstances that can add value to the project.

The risk note present in all projects may be enhanced by the following factors: the project takes longer; the time between the planning and execution phase is extended; the experience of the project manager, of the project team and the partners in the consortium is narrower; methodology and technology to which called for the project is newer and less known [7]. Specifically, research projects are trying to move beyond the current boundaries of knowledge, which further increases the uncertainty in the results, regarded as objectives to be achieved [6].

In terms of project management one should distinguish between risk and uncertainty. If regarding the risk one can make possible scenarios of events occurrence, in case of uncertainty the probability of occurrence and impact can not be identified.

Starting from the definition of risk offered by Opran (2002) “the probability of losing” there can be identified within the projects a series of forms of this loss, depending on the weight of three main factors: time, cost and quality (Figure 1). Thus, if the final product must meet high performance requirements, then that project will be situated close to the peak "quality" [8].

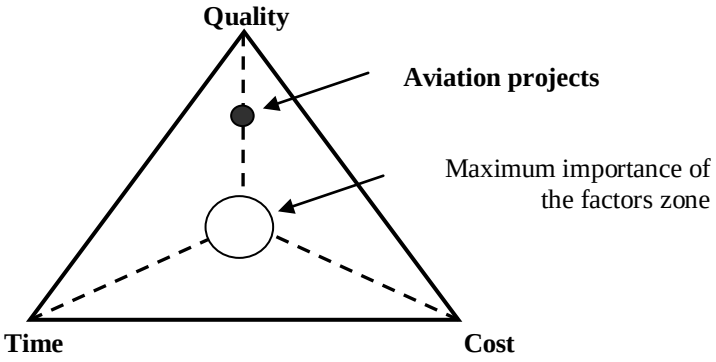

FIG. 1. Positioning diagram in aviation projects

Risk management is the set of methods and means by which the uncertainty is managed, as the basis of risk factors in order to reach the planned objectives. Risk approach as a enhancer factor for progress, turns risk management into a tool that enhances decision-making under uncertainty.

In research and development, the risk is often interpreted in limiting terms, with a negative impact on the goals. The peculiarities of these activities are a enhancer of the risk factor [9]: the uncertainty of the discoveries; the need for creative freedom; the scientific result is a public good; the effect in time of the results; the difficulty of assessing the effects.

3. RISK MANAGEMENT IN MASIM PROJECT

The air system project multi-agent with mobile earth station information management (MASIM) has as main objective the design, development and prototype testing of an innovative system of multi-agent aerial mini-platforms.

In terms of typology [10], MASIM project is primarily a manufacturing project (air mini-platforms), but it includes elements that place it in the category of IT Projects (it develops and introduces a new software).

The MASIM project contains innovative elements in all systems and components and integrates the latest technologies (microelectronics, ICT, software algorithms and composite materials), which can be an additional source of risk.

Through its architecture design and the implementation of a quality product, the simplicity in operation by operators with medium-level qualifications and attractive proposed MASIM captures product market's attention in completely new niche. MASIMs system efficiency, expressed through unique capabilities in saving lives and properties is the objective of end users.

The risk management for scientific MASIM research project is the process of covering the following steps: setting the context; risk identification; analyzing, evaluating and prioritizing risks; developing and implementing the risk management plan; monitoring initial results and improving the initial plan [1].

Although listed as a separate entities these stages interact with each other and with other areas of project management throughout the projects life cycle.

1. Describing the context

Scientific research is based on two pillars: human resources and finance. Unfortunately for Romania, this structure continues to be a weakened one evens at the opening date of the competition, at least for the following reasons:

- a ratio of researchers reported the total active population of 3.64%, compared to 9.2% in Europe [11];
- the lack of internationally recognized researchers in the field;
- Romania’s negative image of due to academic plagiarism scandals, fake diplomas or imposture of Romanian universities [12]
- Romania had the lowest research and development intensity in the EU, at a value of less than a quarter of the EU average [13];
- Romania has not obtained European funding for any grant from 2007 to 2013 in the context of allocating 10 billion EUROs for research [14].

In such a context, project planning could not exclude the possibility of continuing the underfunding trend of research during the project, with repercussions on the objectives set and on the maintaining of the research teams formed.

2. Risk identification

Once the context being set it moved on to the identification of the potential risks based on the analysis of the source and of the problem and the methods used were: checklist, identifying risks based on objectives and risk identification scenarios. Thus, they were grouped into six categories: financial risks; risks related to the project team/ consortium; risks related to information provision; risks related to the context in which research is carried out; risks related to infrastructure and equipment; risks compromising the investigation due to extreme natural phenomena or anthropogenic factors.

3. Analysis, assessment and risks prioritization

In order to analyze identified risks available information from previous research projects were used to determine which is the probability of occurrence of specified events (table 1) and what could be the impact of the consequences of these events [15].

Table 1. Probability Score

Score	**Describing the probability**		
3	Probable	***High,*** it can occur several times during the projects life cycle	> 0,7
2	Possible	***Potential,*** It can occur at least once during the projects life cycle	0,3 ÷ 0,7
1	Improbable	***Low,*** It occurred at least once in similar projects	< 0,3

The potential impact is evaluated based on criteria drawn from the specific research and innovation activity on a descriptive scale of three levels: major, moderate and minor (tab. 2). Prioritizing risks is in relation to level of risk tolerance, which is periodically reset by the project manager depending on the context of projects internal and external environment.

Table 2. Risk Matrix

		impact				
		Minor	Moderate	Major		
probability		1	2	3	**detection difficulty**	
3	Probable	**1, 2, 3**			3	Difficult
2	Posible	**4, 6, 9**			2	Average
1	Improbable	**12, 18, 27**			1	Easy

A useful approach is that of the three regions of risk assigning (tab. 3):

Table 3. Risk levels

Risk index interpretation		
Unacceptable 12 - 27	**- treatment, regardless of cost**	The probability and the consequences are unacceptable, regardless of the benefits. It requires significant cuts, regardless of cost.
Tolerable 4 - 9	**- reduction is possible, but the abatement costs exceed results**	The probability and consequences are alarming. The risk is acceptable provided the measures for its mitigation are applied to an acceptable level.
Acceptable 1 - 3	**- ensuring that risks remain the same** **- monitoring**	The consequences are very unlikely or insufficiently server to produce concern. The risk is accepted as such. It is nevertheless recommended risk mitigation measures.

- Denied region, when the risk is considered unacceptable, whatever benefits it might bring and where risk treatment is imperative regardless of cost;

- Tolerability region, where the risk is tolerable only if the reduction is impossible or if the costs outweigh the damage reduction;

- Acceptance region, where the level of risk is considered negligible.

Factors affecting decisions on risk tolerance include: identification and analysis of treatment of risk needs; prioritizing risk treatment; determining the activities to be undertaken; determining routes to follow.

Risk ranking is done according to the risk index and in situations of equality the impact is the shootout criterion.

4. Development and implementation of the initial risk management plan

Exits of the risk identification and analysis stage are contained in the original plan risk management. The main elements of the risk management plan include roles and responsibilities; risk categories; defining likelihood and impact; risk tolerances reviewed; risk response planning. In the trigger stage of the MASIMO project the risk management plan presented in Appendix 1 was conducted.

Introduction of the criterion of difficulty of detecting as multiplier of risk index is based on considerations relating to the possibility of risk prevention in the context of the difficulty of identifying its causes.

The risk manager has the responsibility, the authority and the resources to implement the risk management plan. By implementing the plan we have conducted a planned response to risk, which was adapted to the significance of the response and realistic in the context of project risk.

5. *Monitoring results and improving the original plan*

With the execution of the project it starts the actual testing of the transposed planning in terms of change management that occur. Monitoring results include the analysis of activities of residual risks, identifying new risks, upgrade risk management plan and evaluate the effects of it throughout the lifecycle of the project.

CONCLUSIONS

Scientific research projects in aviation have a strong innovation embodied by generating partial solutions to identified problems or needs.

Planning scientific research projects in aviation is an important factor in the success or a sure way to failure. The successful approach of risks in the planning stage is based on: identifying those responsible; building and maintaining an environment of consensus among stakeholders (financier, contractor, partners, beneficiaries); identify tools and techniques of risk management; developing strategies for risk reduction.

Plans and risk management strategies are monitored and reviewed throughout the projects life cycle and project management ensures that any amendments are applied.

The risk in a research-innovation project is inevitable and accentuated by the paradox that it has variable costs (which depend on the chosen solution) and fixed benefits (given the purpose and objectives). Conducting such a project is based on certain resource consumption, and future estimates (eg. Technological or fiscal policies), which induces a state of uncertainty of project management when determining the best option.

Risk management in scientific research projects associated with aviation becomes extremely important for all stakeholders: the donor – by identifying the balance between project results and financial resources allocated; the managers – by improving decision-making for targeting; the project team – by identifying sources of risk and approach solutions; the beneficiaries – by the contribution to meeting the needs and adding value to the investments.

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Risk management plan

Risk ID	Risk description	P.	I.	D.d.	Risk score	Risk control measures	Responsible
1. Financial risks							
1.1.	Reducing or stopping funding	3	3	1	**9**	Continuous monitoring of resource consumption and budget corrective action is taken when necessary. Identification of several alternative technologies or constructive. Review the expectations of the parties involved. A structured review of the project documentation, including plans, objectives or previous records project.	Project director
1.2.	Not providing funding for certain expenditure items	2	2	1	**4**		Project director
1.3.	Failure funding deadlines	2	3	1	**6**		Project director
1.4.	Erroneous estimate of the project cost	1	3	2	**6**		Project director Project leaders Economic leaders
2. Risks related to project team / consortium							
2.1.	Lack of qualified specialists for project execution	2	2	1	**4**	All partners must provide qualified human resources and provide specialized training.	Project director
2.2.	Issues related to hiring and keeping young professionals	1	2	1	**2**	Using the platform for publishing project vacancies.	Project director Project leaders
2.3.	Breaking the rules of good conduct in research	1	2	1	**1**	Promoting cooperation and collegiality in order to facilitate the exchange of ideas, mutual constructive criticism and mutual verification of results.	Each researcher Ethics committee
2.4.	Compromise of classified information	1	2	2	**4**	Allowed access to classified information with respect for the principle of "need to know" basis only to persons who hold valid security clearances or access authorization.	Each researcher
2.5.	Breach of confidentiality on intellectual property	1	1	1	**1**	The partners have negotiated an agreement on intellectual property rights, in accordance with national and European regulations, which came into	Project director Project leaders

						force with the actual start of the project.	
2.6.	The multidisciplinary nature of partners	2	2	2	**8**	Project management is structured to ensure ease of communication between technology providers and users, monitoring project progress and developments.	Project director Risk management learders
2.7.	Underestimating the effort required to complete each project	3	2	3	**18**	Continuous monitoring of resources and taking corrective actions when necessary.	Project leaders
2.8.	Underestimating the time needed to produce results	3	2	3	**18**	To ensure the successful completion of the work and the validity of their results, each work package contains necessarily planning, validation and quality assurance.	Project leaders
2.9.	Getting technical results of lower quality than projected	2	2	3	**12**	A technical team with the participation of project responsible will review the technical aspects of the project on each work package. This ensures that the project remains focused on the initial technical objectives. The results are revalued throughout the project life cycle to ensure their validity in terms of end user needs.	Project director Project leaders Scientific leaders
3. Risks related to information provision							
3.1.	Lack of or reduced quality of data needed	2	2	2	**8**	Including in the consortium partner institutions with experience. Free access for researchers to databases of scientific publications in the workplace through research organization to which they belong or a partner organization.	Scientific leaders
3.2.	Difficulties in obtaining the necessary data	2	1	1	**2**		Scientific leaders
3.3.	Limited access to current scientific results	1	2	3	**6**		Scientific leaders
4. Risks related to the context in which research takes place							
4.1.	Incomplete and inadequate	2	2	3	**12**	Compliance of the European Aviation	Scientific leaders

	legislation in the field					Safety Agency regulations on: certification of aircraft and operators, special authorization (under Art. 8 of the Chicago Convention).	
4.2.	Slow procedure for conducting the procurement process	2	2	1	**4**	Establish in advance the timing of the whole process. Creating and updating a database of systematic observation and monitoring market development trend. Choosing the right procedure for awarding a public procurement contract.	Economic leaders
4.3.	Difficulties in information flow between partners	3	3	3	**27**	Establishing communication strategy: the main way of transmitting information will be official documents, meetings, telephone conferences, e-mail sites. The project defines structured management processes. Based on these, decisions and procedures for resolving conflicts will be reported in a qualitatively and will be approved later.	Project manager Project leaders
4.4.	Lack of support from decision makers	1	3	3	**9**	Inviting decision-makers at events dedicated to disseminating the results of the milestones of the project.	Project manager Project leaders
4.5.	Delay in obtaining the approvals, permits and certificates needed	2	3	2	**12**	Assigning responsibilities and following of the algorithm for obtaining approvals, permits and certifications in accordance with regulations.	Assistant manager
4.6.	Communication problems with end users and market	2	3	3	**18**	Ensuring interaction with target groups through	Project director Project leaders

						communication networks of all partners.	
5. Risks related to the infrastructure and equipment							
5.1.	Unsatisfactory infrastructure and research conditions	1	3	2	**6**	An inventory of equipment, technologies and information systems existing in the partners involved. Improving institutional cooperation.	Scientific leaders
5.2.	Lack of modern testing equipment	2	3	2	**12**		Scientific leaders
5.3.	The disposal of existing equipment	3	3	1	**9**	The Technical Commission will review technical aspects of the project and control activities and technical directions.	Scientific leaders
6. Risks to discredit the research due to extreme natural phenomena							
6.1.	The occurrence of major force events (earthquake, fire, flood, war, terrorist attack)	1	2	2	**4**	Partner claiming force majeure has the obligation to notify other members of the consortium within five (5) days and also inform them of the date of cessation of the situation. Identification of variants of further research by overlapping responsibilities and completion of the research team. Regularly updating security plans for mitigating the consequences.	Project director Project leaders Risk management leaders
6.2.	Loss of research documentation for technical reasons	2	3	1	**6**	Making rescue operations (backup) at the end of each stage. The possibility of allocating funds for data recovery operations.	Assistant manager