

Optimizing Resources in Aerospace Missions – An application to the NANOSATC-BR2 Mission.

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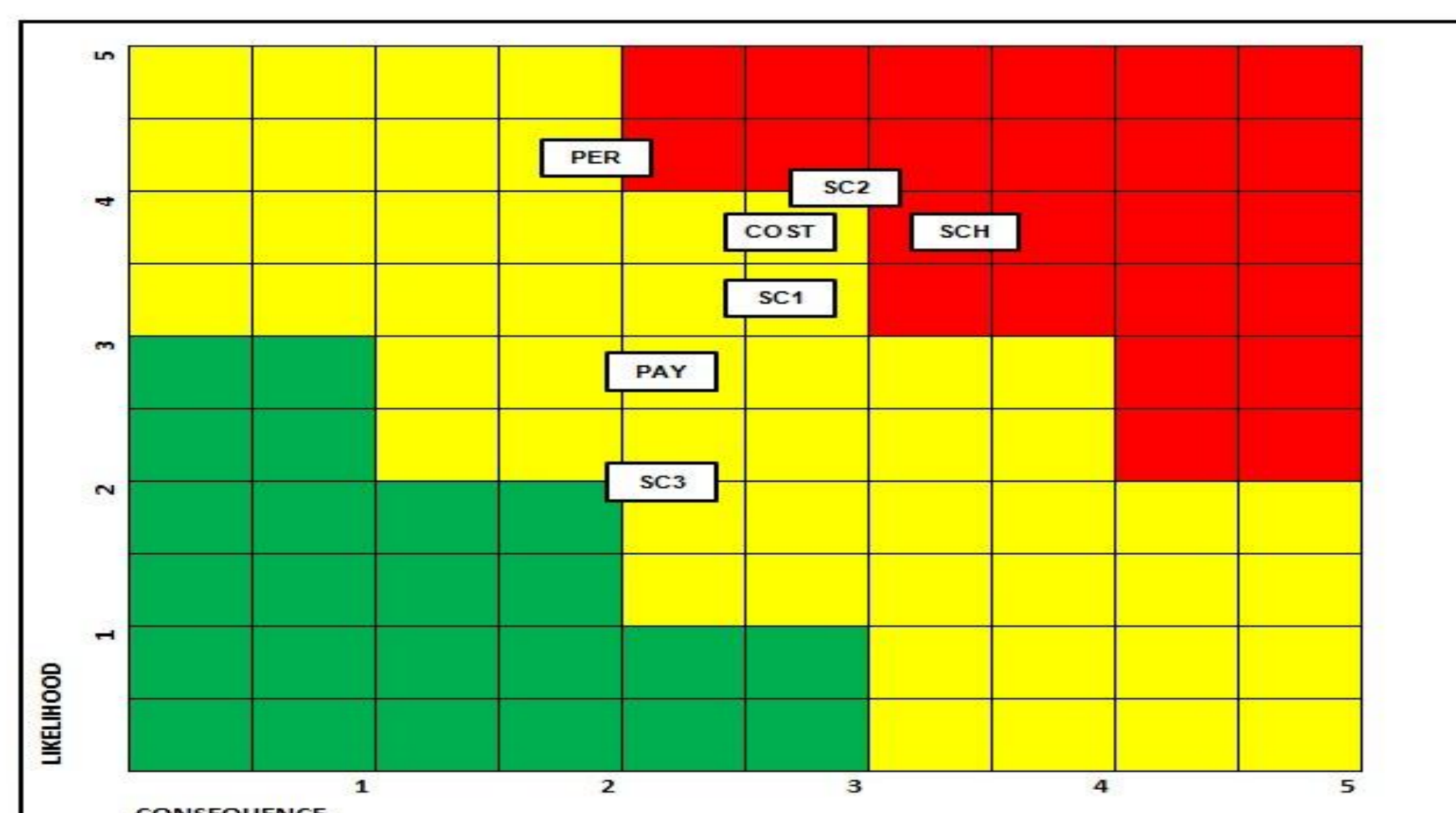
OBJECTIVES

This work has as its main objective to find ways of reducing risks found in aerospace missions, focusing specifically on the Project NANOSATC-BR, Development of CubeSats. In order to find the best alternative to solve each problem, the software *CubeSat Risk Analysis* was used, as well as the decision analysis software *CubeSat Decision Advisor*, with the objective of optimizing the following variables: time, cost and human resources.

For the risk COST, two alternatives were proposed: Obtain financial resources in the beginning of the mission or request for more funds during the mission.. The best option according to the software was the first one, as it can be seen in Picture 3:

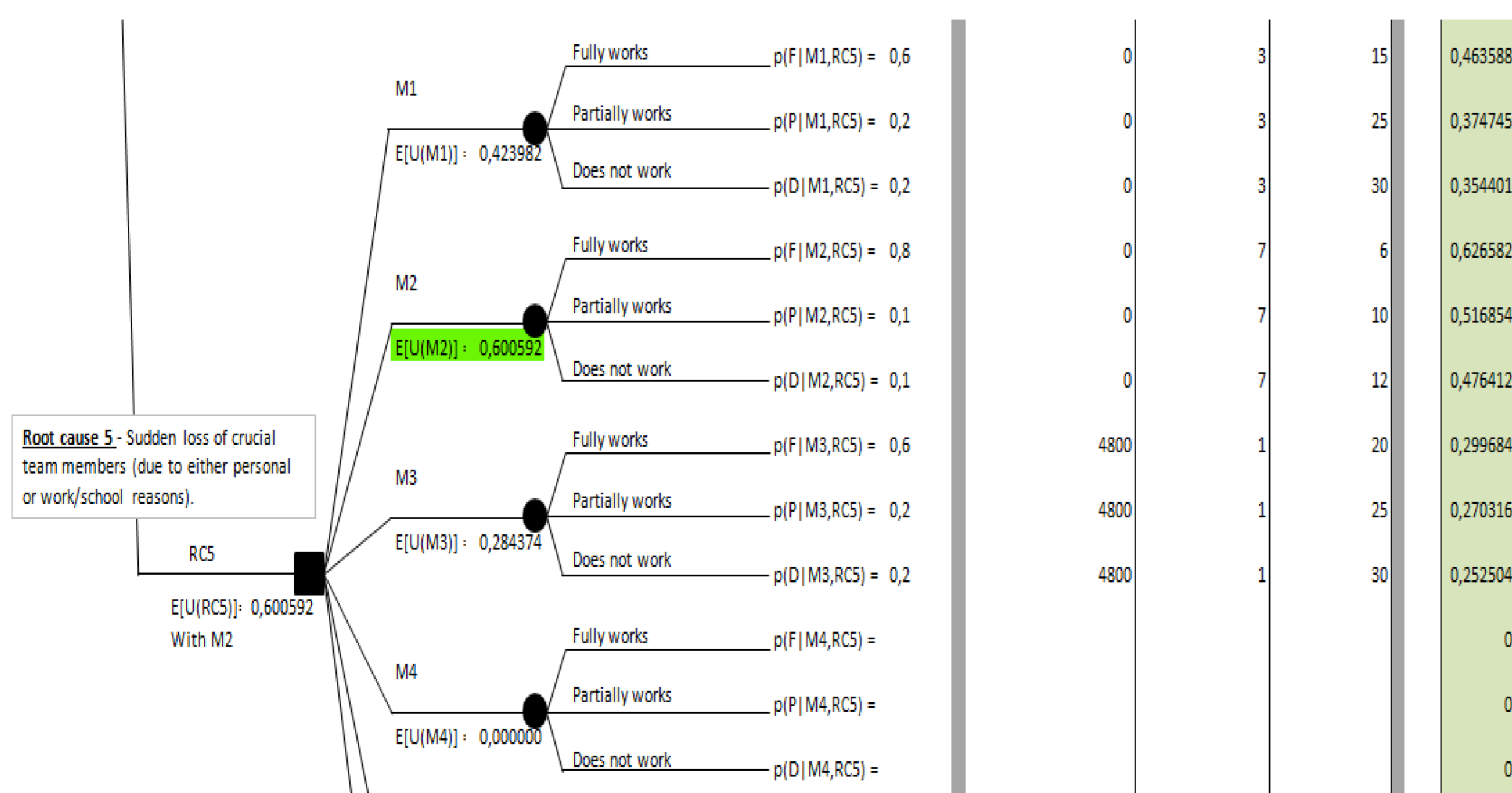
METHODOLOGY

Using the software *CubeSat Risk Analysis*, risks and critical points were detected for the mission NANOSATC-BR2. The risks selected for extended analysis were PER (Loss of human resources and knowledge) and COST (Mission costs), because there is a real possibility of acting for their improvement at this moment. It can be seen in Picture 1 that the risk PER is in the borderline between the critical point (in red) and the high risk (in yellow), while the risk COST is almost being classified as a critical point for the mission:

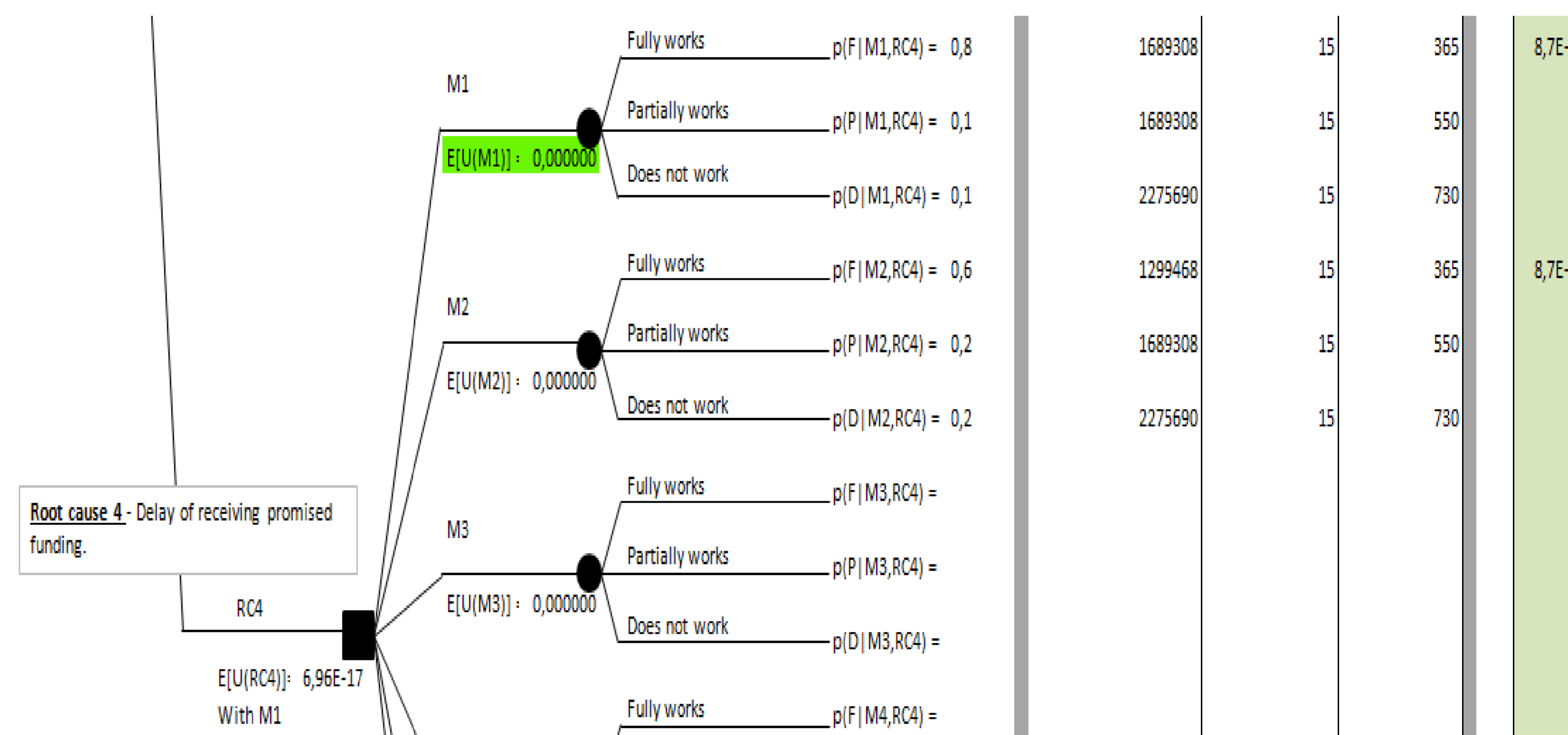


Picture 1: Risk graph for the NANOSATC-BR2

For the risk PER, three initial possibilities were used, being them: Archive organization, Sharing previous experiences in order to avoid old mistakes and the Admission of new members on a regular basis. The Picture 2 shows the results obtained through the software *CubeSat Decision Advisor*; being the second option the best for this case:



Picture 2: Results obtained for the risk PER



Picture 3: Results obtained for the risk COST

RESULTS AND DISCUSSIONS

Due to the complexity involved in aerospace missions, techniques that can avoid loss of experiences and knowledge from previous students that were working on the Project are extremely important, specially when it comes to a mission involving university students, such as the NANOSATC-BR2 Mission. All three possibilities discussed previously are being applied at the same time on the Program.

The risk involving costs is more problematic, once the Mission depends basically on Governmental funds to enable its accomplishment. The bureaucracy represents a huge obstacle for the Mission. This way, one of the proposed solutions is to request a bigger amount of money initially for missions involving small satellites.

It is strongly recommended the utilization of the statistical tools for mission analysis used by this work for other Brazilian aerospace Missions, because it may represent a significant improvement in their organization and efficiency.

REFERENCES

- [1] Katharine Brumbaugh Gamble, Glenn Lightsey: *CubeSat mission design software tool for risk estimating relationship*, 2014, Acta Astronautica 102, pages 226-240;
- [2] Katharine Brumbaugh Gamble, Glenn Lightsey: *Decision Analysis Tool for Small Satellite Risk Management*, 2016, Journal of Spacecraft and Rockets, pages 420 – 432;
- [3] NANOSATC-BR. Projeto NANOSATC-BR – Desenvolvimento de CubeSats. Centro Regional Sul de Pesquisas Espaciais. Santa Maria – RS, Junho 2010.

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