Responses to reviewers’ comments

|  |  |
| --- | --- |
| Comment | Response |
| System of Systems is a concept that is brought up early in the paper but does not carry through the method and analysis.   The paper uses the term "defense projects based on system of systems (SoS) 21-22, and "SoS projects" 25 and "projects using SoS".  These are confusing inconsistent uses of SoS.   In my career,  I have never seen such things.  Projects are based on requirements, needed capabilities and threats, though based on external interconnectivity, projects may be part of a larger SoS context.   The authors don't define SoS early in the paper, nor do they make the case as to what about SoS is risky.  They hint at it in sentence 64-65, but it is not clear if the "whole" represents the whole system or the whole SoS.  SoS is eventually defined on page 4. | Thank you for the important comment. The term was changed to defense SoS. You may find the definition of this term in the line 24 and in the literature review in lines 157-159  |
| Probably the biggest issue was there is no discussion on data analysis in the method section.  No mention of Tree based classification models (creation and use). | It was decided not to use decision trees |
| Section 3 method is one page.  | Section 3 has been expanded |
| The abstract discusses "advanced data science tools" line 11, and the method should describe them.  | Abstract changed to –“Identifying and assessing risk is one of the most important processes in managing complex systems and requires careful consideration. The need for an effective, efficient approach to risk management is considerably more important for defense, because they are exposed to risk already in early stages of development. This paper uses Heterogeneity and Homogeneity analysis among the risk factors with Cochran’s Q test and *I2* statistic in order to present the complexity of the risk factors relevant to defense SoS, and proposes a methodology for identifying, analyzing and monitoring the risks that they face. Findings from an in-depth analysis of 46 classified defense SoS shows a need to focus on three main risks faced by defense projects: insufficient human resources, changes in the original specifications, and lack of other (non-human) resources. The paper also presents some recommendations for minimizing risk factors in defense SoS” |
| While the figure 4 is great, this section only describes the data in lines 156-176 - the 10 interviews,… | Regarding qualitative research, the following were added:The qualitative research started as an exploratory study, consisting of 10 semi-structured interviews with professionals who participated in classified defense projects for developing SoS in the Air Force. The interviewees included project officers, flight-crews, pilots, project managers and systems engineers, who were asked about the projects they participated in and these projects’ risk factors; the association between project budget and the extent of deviation from the planned schedule; as well as the connection between different risk factors and project scheduling delays. After recording and summarizing the interviews, content analysis was performed and triangulation process was conducted in order to confirm each finding presented in the report which was mentioned by three or more interviewees, to ensure trustworthiness.  |
| …the pilot questionnaire for 10 experts and the final survey.   How many survey responses were collected?  How was the data validated?  | Regarding quantitative research, the following were added:Based on results from the interviews, a survey was developed to examine the risk factors faced by SoS projects for defense purposes. Its goal was to determine the segmentation of risk factors for these projectsA pilot questionnaire was first distributed to 10 experts in project management, including senior systems engineers and a professor of industrial engineering, for their evaluation. Based on their responses and comments, a final version of the survey was created. In order to validate the final version of the survey a pilot group was selected in which the questionnaire was passed. The data collected by the survey included the organization’s risk management methodology, the most common risk factors in defense projects, and the main characteristics of organizations that manage to avoid the occurrence of risks. The data collected by the survey included the most common risk factors in defense projects. During the survey, each respondent was asked to select the five most common risk factors in defense projects from the following list:* Risk factor 1: Failure to maintain risk management processes
* Risk factor 2: Delays in supporting infrastructure
* Risk factor 3: Cultural differences among project members
* Risk factor 4: Overly-optimistic scheduling assessment
* Risk factor 5: Insufficient human resources
* Risk factor 6: Lack of other (non-human) resources
* Risk factor 7: Lack of project team’ previous experience
* Risk factor 8: Lack of project stakeholders’ previous experience
* Risk factor 9: Too many stakeholders influencing the project
* Risk factor 10: Complexity of the military operation
* Risk factor 11: R&D required in a new field/area
* Risk factor 12: Overlap between different project processes
* Risk factor 13: Changes in the original specifications
* Risk factor 14: Gap in knowledge management
* Risk factor 15: Dependence on other factors

In statistical analysis, in the first stage, frequencies of the risk factors faced by 46 defense projects were counted. In the second stage, Heterogeneity and Homogeneity among the risk factors was calculated using Cochran’s Q test and *I2* statistic.  |
| Section 3/4. No description of the projects used in the data... what were these defense projects? (aircraft, space, Command and Control, business systems, ground vehicles, etc).   | The projects analyzed in the current paper are all classified defense system of systems (SoS) in the Air Force (please see line 154 and line 166. For reasons of confidentiality we will not be able to disclose the content of the projects. |

|  |  |
| --- | --- |
| Figure 6 is plotted low to high; most authors would plot highest to lowest especially if highlighting the 5 highest risk.  No discussion why the author would hypothesize that all risk should be uniform. | We changed the figure. Please see the new figure (no. 5) that plotted high to low. |
| Section 4 introduces Decision Tree procedure on page 7 line 222.  No discussion how this was accomplished.  There is reference to independent variables, item clusters and items.   Line 225 "item clusters of 19, 20,22, 25 on item 31".  There is no discussion on the full list of items, their definition, nor how these items were identified.   This should all be in Section 3 Method/ Research Design.  Author list the Items used in Figure 7 but not all the other items.  The author provides little literature review, method description and how it was applied to the data for this paper. | It was decided not to use decision trees |
| Line 290 states that "Figure 12 and 13 present the main characteristics of defense organizations that are able to avoid  risk".  The #1 characteristics is a Line 292 Transparent risk management methodology.  This is not mentioned in either figure.  How did the analysis lead to such a finding.  Did the author identify this or did the analysis show this.  Very confusing list -  where is the logic to lead to Lines 292 -300. | We wrote again the section of the results and updated the statistical analysis. Please notice that the results section includes the finding from the interviewees and survey. The results are presented step by step logically. |
| Figure 12 (also backwards low to high) and FIgure 13 are unfinished with no axis labels nor legends. | We changed the figures. |
| Section 6 Conclusion and Recommendations, based on lack of clear description of research method, is questionable.   First the "finding of the current study show the need to focus on three main challenges/ risks..." line 369.   The first is uncertainty... of what?.  The third focus is managing a project under constraints.  All projects have constraints - in cost, schedule, requirements. | Since we changed the results part, all the conclusion and recommendations are now based and well explained on the updated figures and tables. Please see tables 1-2 and figures 5-9 |
| Overall, there was a lot of work in this study and it shows.  However, the manuscript in this current form is missing a detailed section 3 methodology/research design on the data analysis, thus any findings are in question.  You mention several data analytical techniques and show some result figures, but never describe the technique nor how independent variables were identified.  It appears some of the findings are not supported direclty by the data analysis.  | We hope that now the data is clear enough and that there are no missing details in the methodology and results sections.  |
| line 45 ISO standards don't use commas 31,000Formatting on the Results - lines 183 and lines 202 have extra indents on the numbered lists.line 254 "oder", orderline 322  first use of "TTM" spell out acronym.   Strangely, this is a study on defense which does not focus on TTM.  That is a commercial term.  Rather defense focuses on initial operating capability (IOC), which is when unit will be fully equipped and trained to operate and maintain a new system.line 347-349 awkward.   I think the sentence simply states it will be necessary to change the initial design if you change the initial design. | We changed the necessary revisions according to these comments. |
| Review 2 |   |
| Interesting research is presented in the article, but the description of the methodology, results and discussion requires significant re-editing and supplementation.  | We re-wrote the part of the methodology, results and discussion |
| INTRODUCTIONThere is no clearly defined purpose and structure of the article. There is no justification why the presented research is important.  | We re-wrote the introduction and explained the justification of the study. |
| LITERATURE REVIEWNo source for Figure 1. METHODOLOGYThe author presented the method of preliminary research and the verification of the research tool. The method of conducting basic research was not presented. The data analysis method is not described.RESULTSI don't understand why risk factors 11-15 are presented as one "Others" category, but are presented separately in the graphs.The second step of research into the use of a decision tree is completely incomprehensible. Where defined clusters, which were then analyzed? Where are the items to which the analysis relates??How the main characteristics of defense organizations were identified?The presented results are incomprehensible due to the lack of a complete description of the research methodologyDISCUSSIONThe results presented in the discussion will be more understandable if the results are properly described. On the basis of the present description, the presented arguments are not consistent with the presented research results | We added the source of Figure 1.We re-wrote the part of the methodology, results and discussion according to these comments.  |