Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Nicola Garzaniti

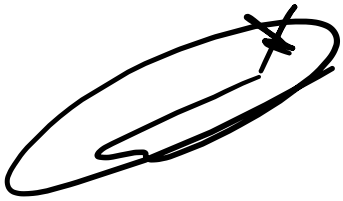
PhD Program: Engineering Systems

Title of Thesis: A decision support system for agile development of complex hardware systems

Supervisor: Associate Professor Alessandro Golkar

Co-supervisor: Professor Clement Fortin

Name of the Reviewer: Associate Professor Alejandro Salado, The University of Arizona

I confirm the absence of any conflict of interest 	**Date:** 21-09-2021

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Thesis quality and overall structure of the dissertation

Overall, the thesis presents doctoral-level research work. The structure of the dissertation is very effective.

Relevance of the topic of dissertation work to its actual content

The relevance of the work is well justified with adequate references and is considered to address a contemporary problem.

Relevance of the methods used in the dissertation

Overall, the candidate makes an adequate selection of methods for the research questions to be addressed. Note the following comments.

The candidate should explain how the formulas used in the dissertation (equations 1 through 5) have been derived/constructed/defined. This is necessary to assess their adequacy.

Explanations of how the different thresholds for using the formulas (or defined as part of the formulas) lack. The candidate should explain how the used thresholds have been defined.

The statement that "These metrics, providing a measure of tasks' intrinsic characteristics, can be used as a proxy to understand if both work and system decomposition … are suitable for Agile implementation" is unsubstantiated, at least when made. Explain how this has been validated.

The use of TRLs is inconsistent with their use in industry practice. TRL refers to the maturity of a technology under development, not of a component under development. For example, one does not simply move from TRL 3 to 4 because a design is built, or from TRL 5 to 6 because a performance test is carried out. Having said that, I do not see why mentioning TRLs are relevant for the work and the examples provided in the dissertation. I suggest removing TRLs and simply discuss verification targets during the system development.

In the cases, it is not clear what the percentages measure in product composition (e.g., number of parts of a specific kind, level of effort…?). Please, explain what product composition measures.

It is not clear why defining roles in the teams is important. Please, describe how these roles are used in the cases and map them to product composition.

The details about the organizations/teams that are used in the cases should be elaborated in more detail. For example, in the third paragraph in Section 4.3, the term "some" is vague, the process to identify drivers is not described, what do team members mean by "interesting" results?

Scientific significance of the results obtained and their compliance with the international level and current state of the art

The work is fairly described in light of the state of the art. However, I am cautious about the depth of the literature survey, since the review omits arguably the most relevant author in implementing Agile practices for HW systems, Rick Dove. The candidate should revisit the literature review explaining how the literature search has been conducted. If necessary, the literature review should be updated to include a deeper critique of current work that addresses the use of Agile practices for HW systems.

The second part of the literature review chapter, which addresses use in industry, often uses unsubstantiated claims (e.g., "The problem can be partially mitigated by adopting Model-Based Systems Engineering (MBSE) approaches and tools. However, this would make the process lose momentum, introducing additional complexity de to reconciling two quite far methodologies." The purpose of this chapter is to justify the research gap addressed in the dissertation. The first part achieves so, but the second seems too anecdotal. The candidate should either support some of those findings with results from existing literature or explain why those anecdotes may be confidently used as supporting evidence. For example, I believe that there is sufficient literature to substantiate some of the claims in Table 4.

The candidate should consider adding a section that consolidates the findings from the literature review and the industry evaluation, as closure to the research gap identification.

In terms of the proposed framework and cases, while the examples clearly introduce HW-specific issues, it is unclear how the proposed framework addresses them for the implementation of agile. A detailed explanation of this unique aspect is necessary.

While I believe there are unique differences between the proposed approach and using, for example, traditional schedule optimization techniques, these differences are not explicitly conveyed in the dissertation. The candidate should explain what is novel in the proposed framework or what benefits the proposed framework provides when compared to traditional schedule or resource allocation optimization methods. For example, a comparison against a traditional critical path approach may be useful.

The cases seem to address only planning of sprints, not execution and re-planning, which is one of the key aspects of Agile (the adaption of the development process as the development progresses). This is a major omission when working with Agile. There are two possible courses of action for the candidate here. First, update the framework to incorporate the iterative nature of agile and extend the cases with notional scenarios of progress to see how the planning adapts to different types of results. Second, update the dissertation to be explicit about this limitation throughout the document.

Given that the choice of tasks depends on the viability metrics, it would be useful to incorporate a sensitivity analysis to show how choosing different thresholds affects the recommendations of the proposed framework.

Relevance of the obtained results to applications

The results have the potential for fast application to real-life applications. However, the candidate should explain how to use the different thresholds and other user-defined parameters in the framework.

Quality of publications

The results of the thesis have been published in diverse venues, including several that are highly respected by academic colleagues, such as IEEE Systems Journal, the International Aeronautical Congress, the IEEE Aerospace Conference, and the IEEE International Geoscience and Remote Sensing Symposium.

The dissertation has produced 2 journal papers. I consider this to be a fair but sufficient number of journal publications. I note that the list in the dissertation only includes published papers, so it may be the case that other papers are under preparation.

Additional issues to be addressed before/during the thesis defense

The dissertation should be written as the work of a single individual. Therefore, please reword the use of first-person plural (e.g., we) by first-person singular (e.g., I) or third person.

The RQ could be formulated to read less vague and more actionable. For example, what is the meaning of “support” in RQ2? What is the meaning of “understand” in RQ1?

In-text citations formatting seems incorrect at times (e.g., Dikert (Dikert et al., 206) instead of Dikert et al. (2016)). Please, correct throughout the dissertation.

Provisional Recommendation

☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*

☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*