

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Mikhail Nikolaev

PhD Program: Engineering Systems

Title of Thesis: Concept selection of innovative complex engineering systems considering systems emergent properties

Supervisor: Professor Clément Fortin, Skoltech

Name of the Reviewer: Associate Professor Henni Ouerdane

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Date: 16-11-2022
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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

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.

The doctoral thesis manuscript is composed of 5 chapters, including the Introduction and Conclusion, followed by an abundant list of references, and 5 appendices containing useful supplemental material. The chapters and sections are well balanced, offering a good reading of the reported work. Note that two appendices are documents certifying the actual implementation of the method develop in the PhD thesis by two companies.

- The relevance of the topic of dissertation work to its actual content

The topic of the dissertation is of obvious relevance to the complex problem of decision making in modern systems engineering. This is well illustrated not only by the literature view (Chapter 2) but also and critically by the 4 case studies detailed in the core of the thesis manuscript (Chapter 3). The case studies,

which pertain to the oil and gas industrial sector, are not mere illustrative cases as they demonstrate that the developed methodology can be implemented in real-life by companies.

- The relevance of the methods used in the dissertation

The main methods used are based on the design research methodology (DRM). The approach adopted in the thesis is relevant as the principles of DRM permit to address complex problems in a multidisciplinary project, notably when it comes to decision making. Interestingly, systems' emergent properties are assumed to be "fundamental attributes" to ameliorate design decision making, while not solely considering quantitative/mathematical approach.

- The scientific significance of the results obtained and their compliance with the international level and current state of the art

The scientific significance of the work is demonstrated through the systematic and rigorous application of the DRM methodology, and the successful implementation of the proposed method in real-life cases. The research question is carefully crafted (as illustrated by Fig. 3 in the Introduction) and the results well discussed.

- The relevance of the obtained results to applications (if applicable)

The relevance of the obtained results to applications is clearly demonstrated as this is one of the practical objectives of the doctoral research to apply the developed framework to real-life problems, notably in the oil and gas industry sector.

- The quality of publications

The work reported in the thesis is the basis of 5 scientific publications, 4 being indexed in Scopus, and 1 published in a national Russian journal. Out of the 4 indexed in Scopus, 1 is an article published in a high-impact journal, while the other 3 are proceedings published by reputable conferences. This shows that the doctoral work is of good international standing, which attracts attention.

The summary of issues to be addressed before/during the thesis defense

From the scientific viewpoint I see no particular issue to be addressed before the thesis defense. The author of the thesis made every attempt to clarify the definitions and his approach to better substantiate his claims. The author also has a clear vision for further development and strengthening of the developed approach. The thesis is overall well written, and I have no particular comment except that the abstract is revised by sharpening or making it less "jargonic" from the outset, hence more accessible to non-specialist readers. Note that sentences like: "As the basis for his work, the author uses research results kindly provided by his colleagues from the Systems Thinking Group of Skoltech: C. Fortin, Y.A. Brovar, and Y.A. Menshenin" are a form of acknowledgment and should not be in the abstract, which should remain a formal brief account of the work. Last, I ask that a choice is made for the bibliographic referencing style: either numerical or alphabetical order but not a mix of both with numbers in the text and alphabetical order in the reference section.

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