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Subben's checklist and the quality of articles in OR

This short article presents two itemed lists that may be a helping hand during the assessment of a scientific article in the field of mathematical optimization/operations research, be it your own, a Masters' or PhD students', or even a paper that you are refereeing for a journal or a conference. The first list ("Subben's checklist") describes necessary ingredients of a complete article, while the second list provides criteria for assessing the quality/scientific value of an article.

1. Subben's checklist

One day at the Department of Mathematics, Linköping University, Linköping, Sweden, during Spring 1993, while the second author was still affiliated with the research division in mathematical optimization, the authors had a very interesting conversation with our then research director, Prof. Subhash Narula, on the principles of article writing. We specifically discussed what – in our field of study, at least – constitutes the necessary and sufficient core content of any complete research article in OR. We believe that the discussion emanated from all of us recently having had the unfortunate duty to be referees on rather poorly written papers – even incomplete ones – and hence discussed not only the quality of papers in general, but in particular if there were simple ways to assess an article's "completeness".

Subhash Narula (fondly nicknamed "Subben" by the mathematical optimization team) had a very clear vision of his viewpoint on the matter, and could quite quickly establish a few necessary "items" that must be in place in any article in our field, in order for it to possibly be complete. The authors also contributed, and notes were taken on the occasion. These notes have since then been slightly updated and stored at a place ready at hand – you never know when the list may come in handy!

1. Relevance	motivation, need, benefit; why interesting?
2. Background	history, state of the art; framework, delimitations
3. Motivation	lack in existing knowledge or methodology
4. Remedy	proposal of actions in order to remove the lack of existing knowledge or methodology
5. Hypothesis	description of the research question(s) considered
6. Realization	presentation of the new contributions to science
7. Analysis	validation of results, conclusions, consequences; future research opportunities
8. Method(ology)	choice of research methodology

Table 1. Subben's checklist.

During the years the list and the corresponding phrases have expanded slightly. Some 20 years after the above-mentioned conversation the second author was enrolled in a PhD course on scientific methodology at Chalmers University of Technology called “Theory and Methodology of Science”, and whose students (masters students as well as PhD students) typically had research topics within finance and logistics. During a few years of enrollment in this course he gave assignments to these students, in which they were supposed to read articles in an unfamiliar territory (such as papers of the authors of this article), to try to pinpoint whether all the items in Subben’s checklist were in fact covered. They did a very good job, despite the fact the most of them were not PhD students in a quantitative field of study. In fact, the second author was subjected to a proposal to add to the list the now eighth item, motivated by the fact that in some fields of study represented by the students, there were several possible “angles of attack”.

Table 1 below shows the current version of “Subben’s checklist” of necessary items in a complete OR paper, sorted roughly in the order they may be revealed in an article:

2. Criteria for evaluating the scientific value of an article

Table 2 provides a (probably still incomplete) list of criteria for evaluating scientific questions, research, and results has been assembled by the authors during a period of some 10 years.

As a final note, we have two suggestions to the reader:

(a) Next time you prepare an application to a research foundation, write a manuscript, or read someone else’s work as a reviewer, examiner or supervisor, try to use the above lists in order to assess what you are writing or reading.

(b) If you have any comments on the lists, please contact the authors, who would be very happy to receive comments.

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Relevance	Is the research question (RQ) motivated by any needs or potential benefits of results obtained? (Relevance can be internal [for the scientific subject itself] or external [for practice].)
Generality	How comprehensive is the RQ and how universally applicable are the results?
Durability	Have the RQ and results a short or a long life? (Are they, for example, technology dependent?)
Scientific foundation	Are the RQ and research work based on a solid foundation in theory and/or methodology?
Scientific height	How big is the progress and the difficulty of reaching it?
Originality	Are the RQ or methodology unique, creative or innovative, or of the established kind?
News value	Is there an interest in the RQ and results (within, or outside of, the scientific world)?
Integration	How much previous knowledge is improved/summarized? Does/can the work connect several scientific fields, in the paper or in possible future research?
Consequences	How big is the influence and usefulness of the work (within or outside of the scientific field)? (Both can be about practical applicability and knowledge advancement in a field.)
Realization	Is the research methodology and approach appropriate? Have they been used correctly? Is the work technically correct? Are any experiments (if any) possible to reproduce?
Consistency	Is the level of ambition stated in the motivation consistent with the results and conclusions?
Availability	Is the work presented such that it can be critically scrutinized? Has it been appropriately described and disseminated?

Table 2. Criteria for evaluating the scientific value of an article.