University of Bergen
Faculty of Humanities

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Evaluation of Andrea Saltelli for prof. II in theory of science

Background and the committee's work

In letter, dated 12.04.2016, the Faculty of Humanities appointed the following committee to evaluate Andrea Saltelli's qualifications for a professorship.

- Prof. em. Ragnar Fjelland, UiB
- Professor May Thorseth, NTNU
- Professor Johan Arnt Myrstad, Nord universitet

The Faculty appointed Ragnar Fjelland as leader of the committee.

Basis for the evaluation has been:

- Guidelines for evaluation of applicants for professorships and national professorial promotion. (In the following referred to as "Guidelines".)
- Regulations concerning appointment and promotion to teaching and research posts, cf. the Act of April 2005 relating to Universities and University Colleges section 6-3(6).
- Guidelines for the evaluation of professorial qualifications on appointment and promotion, as recommended by the Norwegian Association of Higher Education Institutions on 25 November 2002.

According to the Guidelines, the job description is part of the basis for the evaluation. However, in this case there is no job description. The candidate applies for a position as prof. II, related to the project MAGIC at SVT. Therefore, in this evaluation the project and the profile of SVT will be used instead of a job description.

This report is organized in the following way: First, a preliminary description of the candidate is given. Then his scientific and scholarly work is presented. Then the

criteria for evaluation are discussed, with a subsequent discussion of the candidate's qualifications in relation to the criteria. Finally, there is a conclusion.

The committee has communicated by e-mail. The report is unanimous.

Preliminary presentation of the candidate

Andrea Saltelli was born in 1953, and he is an Italian citizen. He has a doctoral degree in inorganic chemistry from Roma La Sapienza University, and successively three years of physics studies. In the period 1977 – 1979, he was a fellow of the Italian Nuclear Authority, Rome, and in the period 1980 – 1981 he was a fellow of the Argonne National Laboratories, Illinois, USA. From 1982 until 2015 he was first a researcher, and then Head of Unit of Econometrics and applied statistics at the European Commission Joint Research Centre, Ispra, Italy. Saltelli is at present guest researcher at Universitat Autònoma de Barcelona and visiting fellow at SVT.

He has led about twenty large research projects, among others projects within the fourth, fifth, sixth and seventh EU framework programs. He has also been the principal organizer of several scientific meetings and conferences and last year he was key organizer of Significance Digits: Responsible use of quantitative information, in Brussels.

The candidate has had a key role in the training of methodologies for quantitative and qualitative methods of use in impact assessment, both within the Joint Research Centre, and in the training offered to other branches of the European Commission and the European Parliament. He has taught in a large number of summer schools for international students on sensitivity analysis and composite indicators and on the "ethics of quantification".

Scientific and scholarly work

Saltelli has submitted fifteen publications for evaluation. All of them have been published during the last five years, and all have co-authors. Saltelli is the first author of ten of the publications.

The three first publications have been published in the collection *The Rightful Place of Science: Science on the Verge* (2016). The first article has the title "Who will solve the crisis of science?" (with J. Ravets and S. Funtowicz). The article starts by referring to J. P. Ioannidis highly influential article "Why most published research findings are false" (2005) and a later article (2014) where Ioannidis estimates that as much as 85% of research funding is wasted on shoddy science. As announced in the title, the article describes a crisis not only in the governance of science, but also in science itself. Symptoms of the crisis are numerous examples of lack of reproducibility of research findings, biased peer-reviews, the uses (or rather abuses) of journal-based metrics (for

example Journal Impact Factors). The authors argue that science itself will not be able to solve the crisis, and their own recommendations can somewhat simplified be characterized by the key-word "democratization of science". This view is in accordance with the framework that was developed more than two decades ago by Saltelli's two co-authors Funtowicz and Ravetz to cope with scientific problems in situations where uncertainty is irreducible and decision stakes are high. They coined the term "post-normal science". One of their recommendations was what they called "extended peer review": The traditional scientific peer review process should in these cases, among others, be supplemented with the views of non-experts. A similar view – although more abstract – was earlier advocated by the philosopher of science Paul Feyerabend.

Saltelli's strength is his ability to address specific issues where scientific knowledge plays an important part in societal decisions. As an expert in the uses of mathematical models and decisions in risk assessment, he is particularly concerned about the uncritical "Trust in Numbers" (to use the title of T. Porter's book) that we find among many decision-makers. An example is the second article from the collection mentioned above, "The Fallacy of Evidence-Based Policy" (with M. Giampietro). Saltelli and his co-author argue that the very project of evidence-based policy is "based on a series of radical simplifications and linearizations". They further argue that "[T]he hubris that lies behind this approach increases the fragility of the system, principally in relation to 'unknown unknowns'..." (p. 42).

Saltelli also criticizes the abuse of mathematical models and numbers in cases where the cause is laudable, for example in the case of climate change research. This is the topic in, for example, "When All Models are Wrong" (with S. Funtowicz) and "Climate Models as Economic Guides: Scientific Challenge or Quixotic Quest?" (with P. B. Stark, W. Becker and P. Stano). In the first of these two articles Saltelli and his co-author focus on the kind of pseudoscience which is characterized by "spurious precision, for example, when a result is given with a number of digits exceeding (at time ludicrously) any plausible estimate of the associated accuracy." Instead of developing more and more complex models in an attempt to cope with the complexity of the problem described, they argue in favor of simpler models that enable us to understand how assumptions and outputs are linked. In the second article, Saltelli and his co-authors argue that climate models may help us to understand climate. However,

> "...when we attribute to them predictive capabilities and attempts to introduce them, through political processes, into our policy planning, the numbers pollute the debates with spurious impression of rationality, prediction, and control. One danger for society is that we will be condemned to endless debates over uncertainties, with models deployed to support various competing positions about which policy pathways to follow. Another, just as serious, is that, with excessive confidence in our ability to model the fu-

> ture, we will commit to policies that reduce, rather than expand, available options and thus our ability to cope with the unknown unknowns of our future."

Evaluation

The Norwegian version of "Guidelines" ("Veiledning for bedømming av søkere til professorater og professoropprykk") has a short paragraph with the following:

> "Humanistisk forskning er mangfoldig og skal være det. Den nasjonale standarden må derfor ikke oppfattes rigid. Men det er til stor fordel for det humanistiske miljøet i Norge om de forventninger om kvalitet, bredde og dybde som fremholdes i denne veiledningen blir respektert." ("Research in the humanities is – and should be – diverse. The national standard must therefore not be regarded as rigid. But it is a great advantage for the humanities in Norway if the expectations of quality, breadth and depth that are emphasized in these guidelines are respected." (our translation)).

SVT is administratively a part of the Faculty of the Humanities, but is interdisciplinary in nature and serves most of the faculties at UiB. In our evaluation we have used the guidelines and regulations referred to at the beginning of this document, but we will not apply them too rigidly.

As head of Unit of Econometrics and applied statistics at the European Commission Joint Research Centre in Ispra Saltelli was an internationally recognized expert in the field of risk analysis. He has a long list of publications, and his activity – in both teaching and publication – has even been increasing during the later years.

Saltelli's academic qualifications are beyond doubt. However, the crucial question is if he is qualified for a professorship in theory of science. This has to be decided in relation to SVT's profile. We find a description of the center and a characterization of "theory of science" in the strategy plan for the center ("Strategi 2012 – 2015, Senter for vitenskapsteori). (The new strategy plan is not ready yet, but so much can be said that it will not radically change the profile of the center.)

The strategy plan's introduction emphasizes that "theory of science" ("vitenskapsteori") shall be taken in a broad sense, and shall comprise all kinds of studies of science, including sub-disciplines like sociology of science, philosophy of science etc. It is further emphasized that thorough knowledge of the science one studies is required. The term "double competence" is used. It is not required that one be able to carry out scientific work in the field one studies, but it is required that one is able to enter into an informed dialogue with scientists in the field.

When this is combined with the general requirement of the "Guidelines" that "In order to qualify as a professor, it should be possible to refer to academic work that, in scope and quality corresponds to two doctoral dissertations", the task of the committee is relatively simple. Saltelli has a doctoral degree in inorganic chemistry, which is highly relevant for the field he is studying. None of the submitted publications are part of his doctoral dissertation. The question is then if his submitted publications are equivalent to a doctoral degree in theory of science.

The committee will not go into details. Of the 15 publications that Saltelli has submitted, almost all will qualify as theory of science, and they are particularly relevant to the work carried out at SVT. Taken together they more than satisfy the requirements for a doctoral dissertation in theory of science.

Conclusion

Andre Saltelli is no doubt qualified for a professorship in theory of science.

Bergen, Trondheim and Bodø, 18.5.2016

Ragnar Fjelland	May Thorseth	Johan Arnt Myrstad
sign	sign.	sign.