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Measuring interdisciplinarity of research grant applications.

An indicator developed to model this selection criterion in the ERC's peer-review process

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Introduction

Scientific experts having to evaluate the interest of research projects submitted for grant to the European Research Council (ERC) must lean on the four “frontier research” criteria among which: “... *it pursues questions irrespective of established disciplinary boundaries, involves multi-, inter- or trans-disciplinary research that brings together researchers from different disciplinary backgrounds, with different theoretical and conceptual approaches, techniques, methodologies and instrumentation, perhaps even different goals and motivations*”, according to the EC's High Level Expert Group report (2005) assertions and that we defined in our DBF project (Hörlesberger *et al.*, 2013) as interdisciplinarity.

Background

Interdisciplinarity is used as a proxy to infer self-consistently the presence and proportions of characteristic terminology associated with individual ERC panels, thereby revealing the intra or inter-panel character of a proposal. It was built upon a previously successfully tested approach that the frequency of occurrence and distribution of research field specific keywords can classify and characterize research fields. While the core of the approach has been retained, the computation has been adopted and fine-tuned to the grant scheme under study. The underlying basic hypothesis is that the larger the proportion of inter-panel keywords, the more interdisciplinary is the proposal. To this end, each keyword is labeled according to its statistical frequency across all panels, filters are applied to distinguish relevant from irrelevant keywords, and the tallying of keywords with their assigned panels is assessed to classify each proposal with respect to its share of inter-panel keywords.

Data and Methodology

Primary data are directly obtained from the documents supplied by the researcher. Each project proposal is indexed by keywords (KW) extracted from its textual information. After validation, we apply the diffusion model approach. First, the so-called Home Panel (H-P) terms are defined. We assumed KW which are specific for a panel occurred with a higher probability in that panel rather than in others. This probability is defined by the frequency of one KW in a panel divided by the number of proposals in this panel, namely the relative term frequency ($rtf_{KW/panel}$). Then, for a KW, we calculate its $rtf_{KW/panel}$ in each panel and the panel with the highest probability is declared to be its H-P. So, we obtain for each H-P the list of its H-P terms. Therefore the complete terminology associated to a panel consists of the union of its H-P term list and the set of terms imported from the other panels and we refer to as “abroad terms”. In order to make the lists of H-P terms more consistent, we use the Gini index, a measure of the inequality of a distribution, varying from 0 to 1, a value of 0 expressing total equality and a value of 1 maximal inequality. It is commonly used in economics as a measure of inequality of the income or wealth. It is, in this study, employed as a measure of the dispersion of a KW. A Gini index of 1 tells us that the KW is very specifically limited to only one panel. Conversely, a Gini index equal to 0 means a completely uniform distribution and indicates that the term occurs in all the considered panels. We define a cut-off threshold to discard KW which dispersion will be considered excessive. Finally, the tallying of KW with their newly assigned H-P is assessed to calculate an index for the share of abroad terms in the list of KW representing the content of each project proposal. The underlying assumption is that the larger the proportion of abroad terms, the more interdisciplinary a project proposal is.

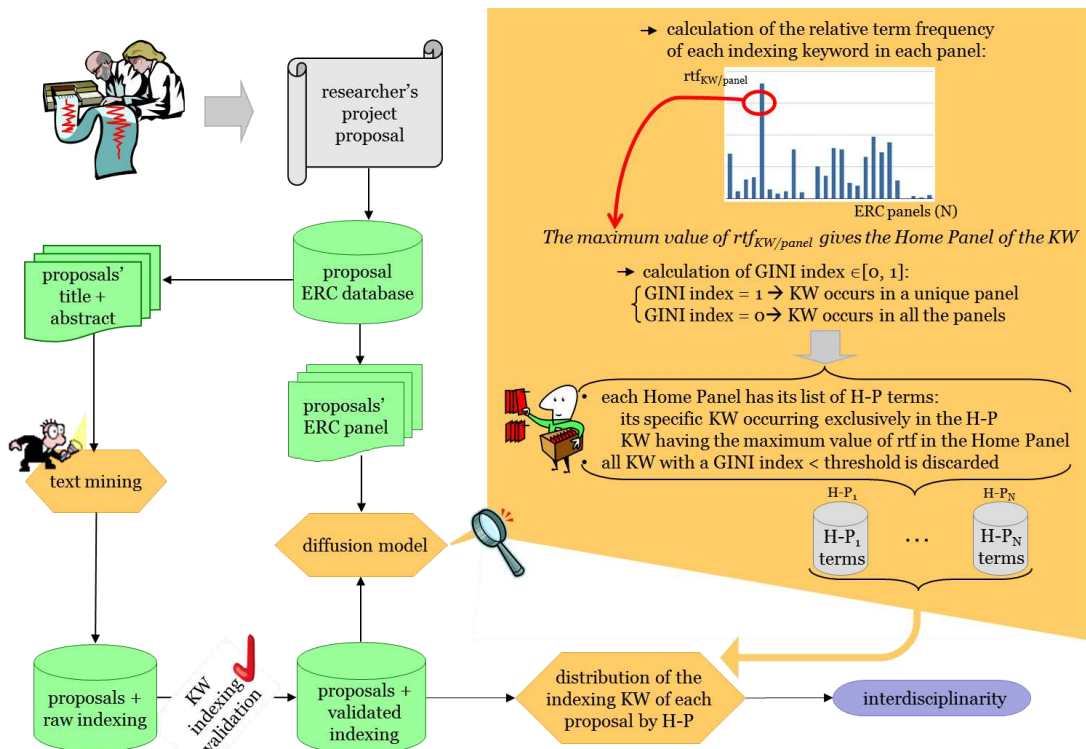


Figure 1. Methodological schema of the evaluation process of the interdisciplinarity of research grant applications

The Case Study

We applied our methodology to a case study coming from project proposals submitted to the ERC 2009 Starting Grant Call.

Table 1. Distribution of successful and non-successful proposals submitted to the ERC 2009 Starting Grant Call

	ERC StG 2009	Dataset (6 panels)
Proposals	2.503	198
Successful	244	41
Non-successful	2.259	157

Among the 19 ERC panels representing Life Sciences (LS) and Mathematics, Physics, Chemistry, Engineering & Earth Sciences (PE), we chose 6 panels with a balance between LS and PE as well as between basic and applied fields.

The analysis shows the results for ERC panel PE1 (Mathematics and Mathematical foundations) which received 39 submissions, 11 of them successful. The value of Interdisciplinarity in this example is the share of abroad terms calculated with a Gini index cut-off threshold of 0.1.

In the DBF project, we introduced a statistical discrete choice model (DCM) to estimate the decision probability for a proposal to be accepted on the basis of measured attributes of "frontier research" (Scherngell *et al.*, 2013).

We studied in a proof-of-concept approach the influence of those attributes on the success probability and conducted an initial analysis of the *ex-post* comparison between the indicator-based scientometric evaluation and the empirical peer-review process. Interdisciplinarity is one of the five indicators we developed in the context of this project and it is an element that proves to influence significantly the selection probability of the projects.

The results obtained with Interdisciplinarity are encouraging and we are experimenting with it on a different dataset from e-Corda.

We also have to introduce another dimension to that indicator: the diversity of the sources (H-P) of abroad terms, on top of just counting them.

Acknowledgments

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