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Agriculture and Human Values

Bias in peer review of organic farming grant applications

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Abstract

Peer reviews of 84 organic farming grant applications, submitted to The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) in 2001, were analyzed to investigate if peer reviews are influenced by the assessors' affiliation to two very different types of agronomy (organic vs. conventional) and to what degree assessors distinguish between scientific quality and societal relevance. Fifteen assessors were grouped into three groups (1) scientists with affiliation to organic farming research, (2) scientists without affiliation to organic farming research and (3) users of organic farming research. The scientist assessed quality as a sum of societal relevance and three scientific criteria whereas the user group only assessed societal relevance. The analysis showed poor agreement between scientist groups for all quality criteria except applicants' qualifications and a clear influence of the assessors' affiliation to organic farming. Scientists, who were experienced in organic farming research, were more in agreement with the user group concerning relevance than assessors without this experience, and the assessment of relevance was closely correlated to the assessment of the scientific quality within each groups. As both scientific groups did not clearly distinguish between societal relevance and scientific quality, the idea of an objective science is challenged. The contextual values, which are associated with the norms of good agriculture, were not clearly distinguished from the constitutive values of science, which are associated with the traditional norms of good science. The analysis brings up the question whether organic vs. conventional applications should be mixed for review regardless of the reviewers.

Key words: Value inquiry, objective science, scientific quality, societal relevance, and attitudes.

Introduction

Organic and conventional agriculture are rooted in counter paradigms often referred to respectively as alternative and dominant. Depending on context, the dominant paradigm may also be called conventional or mainstream but all these terms refer to the same basic understanding (Beus and Dunlap, 1990; Christensen, 1998; Harding, 1998).

In the alternative paradigm, human beings are seen as an inseparable part of nature, which imposes intrinsic limits on our manipulative powers and an inherent tension between present economic growth and sustainability. The alternative paradigm is linked to a social counter movement to industrial modernism. In the dominant paradigm, nature is seen as a resource for humans without intrinsic worth or limits to our manipulative powers. The limits, such as they are, are seen to stem from our current ignorance of natural processes. Continually increasing economic growth is considered to be necessary to provide the financial and technological resources to address problems of unsustainability, and the alternative paradigm is regarded as extreme and unnecessary.

The counter paradigms are reflected in different understandings of sustainability (Neumayer, 1999; Ayres et al., 2001), farming practices (Beus and Dunlap, 1990) and agricultural science (Perkins, 1982; Miller, 1985). Strong sustainability is linked to the alternative paradigm whereas weak sustainability is linked to the dominant paradigm.

Paradigms are coherent frameworks of knowledge, values and beliefs within which experiences are interpreted and made meaningful. Rationality is created within paradigmatic frameworks, which makes it difficult to resolve extra-paradigmatic disagreements. Neumayer (1999) investigated the paradigmatic characteristics of strong and weak sustainability and concluded that there exists no scientific answer to which of the two paradigms is “correct”. Support for one or the other depends much on basic values and beliefs.

Even if organic agriculture is closely linked to the alternative paradigm and conventional agriculture is linked to the dominant paradigm, individuals within each grouping may hold different paradigmatic positions. Some organic farmers may even hold more conventional positions than conventional farmers (Beus and Dunlap, 1991), because pragmatism may uncouple ideals and actions, and farming methods may be adopted even though farmers do not share the philosophy behind them.

A number of papers deal with the relationship between farmers' paradigmatic attitudes and their actions (Beus and Dunlap, 1991; Egri, 1999) but it is unknown whether paradigmatic positions influence the core values of science and thereby the peer review process in the scientific community.

In a cognitive context, research and teaching are both knowledge and learning systems (Alrøe, 2000), and the alternative-dominant counter paradigms represent different positions to knowledge and learning (Huckle and Sterling, 1996; Harding, 1998). In the dominant paradigm, objectivity and facts are opposed to subjectivity and values. The role of the scientist is assumed unbiased and impersonal and progress is based on rationality and advancements in science and technology. The alternative paradigm points at limits to the conventional science and stresses the necessity to integrate values and beliefs in the learning processes (Francis and King, 1997; Alrøe and Kristensen, 2002; Packham, 2003). Personal involvement and biases are considered unavoidable and paradigmatic transformations are considered necessary to develop a sustainable development through changes in our way of learning (Huckle and Sterling, 1996; Francis et al., 2001; Lieblein et al., 2000). Key elements in this transition involves changes from (1) objective to participatory approaches, (2) reductionistic to holistic approaches, (3) discipline to problem approaches, (4) universal principles to site-specific approaches and (5) individual learning to interdisciplinary team learning.

Acknowledging that organic farming is rooted in an alternative paradigm, which holds different views on knowledge and learning from the dominant paradigm, one may ask whether scientists with different paradigmatic positions evaluate scientific quality differently. This is an important question relative to the peer review process of scientific manuscripts and grant applications.

This paper asks whether the evaluation of grant applications is influenced by peer reviewers' affiliation to two very different types of agronomy (organic vs. conventional) and to what degree peer reviewers distinguish between scientific quality and societal relevance.

Materials and Methods

In spring 2001, the Swedish Government allocated 69 MSEK (7.5 MEUR) for research in organic agriculture and horticulture over the period 2001-2003. Funds were allocated by The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (henceforth FORMAS) to 23 projects in the following areas: The ecology of production systems (7 projects), plant nutrient cycling (6 projects), animal husbandry (3 projects), technique (1 project), economics (1 project) and miscellaneous (5 projects). Projects were chosen among more than one hundred grant applications.

Two committees were appointed to evaluate the grant applications, a scientific committee and a user committee.

The scientific committee consisted of 7 scientists from Denmark and 3 from Sweden. The Danish scientists were specifically chosen for this particular research programme due to their research experiences. All were or had been leaders of research projects in organic farming and all were associated to the Danish Center of Organic Farming Research (DARCOF), which is a so-called " research center without walls" where research is performed in interdisciplinary collaboration between participating research groups. The Danish scientists were chosen because they were considered to be highly qualified within the research area of organic farming and because they were considered to be unbiased in an ongoing Swedish debate about the relevance and role of organic farming.

The three Swedish scientists had affiliation to FORMAS and no formal experiences with organic farming research. They were chosen because they were considered to be highly qualified from a general scientific perspective and because they were expected to hold views on scientific quality and relevance, which corresponded to the Swedish scientific establishment.

FORMAS decided to have these two complementary groups of scientists in order ensure balance and broadness in perspectives. Based on the described characteristics, two different groupings were recognized in the scientific committee, scientists with affiliation to organic farming research (ORG+) and scientists without such an affiliation (ORG-).

The user group (USER) consisted of 5 people representing different organizations with clear affiliation to the organic farming sector (e.g. farmers, traders and consumers). The user group was assumed to benefit from the research program.

The scientific committee used 4 criteria in the peer review process, 3 of which were meant to reflect the scientific quality and one criterion was meant to reflect the relevance regarding society and the organic sector. Each criterion was described in detail in a written instruction given to all committee members before peer review. The scientific criteria were presentation of the problem (P), methodology (M) and qualifications (Q).

P. By “presentation of the problem ” was meant scientific content, novelty value and coherence between research objectives, hypotheses and theoretical context,

M. By “methodology” was meant the appropriateness of methods, time schedules and costs,

Q. By “qualifications” was meant the applicant’s likelihood to carry through the project and obtain the expected results.

The relevance criterion reflected how relevant the project was in order to contribute to the development of organic agriculture and horticulture and to the society as a whole. Each criterion was graded in six on a marking scale. The best mark was 6 and the poorest was 1. The user committee assessed only the relevance of all grant applications whereas the scientific committee assessed all criteria.

In the general description of the research program, it was stated that research should be multidisciplinary, there should be close links between theoretical and applied aspects and participatory research was encouraged.

All grant applications, which more than 2 assessors reviewed, were included in the analysis leaving 84 applications. On average, 5 assessors with minimum 3 and maximum 7 assessors reviewed each grant application. The number was determined by the resemblance between the assessors' scientific competences and the content of the applications. For each grant application the most competent expert within the given area was appointed as chairman. The final decision of grant funding was taken in discussions among all assessors. The change to get funding was related to the topic because it had to be secured that a range of research topics was covered and within certain topics there were more applications than within others.

In order to investigate whether peer reviews were influenced by the assessors' affiliation to organic farming, assessors were categorized into three groups; (1) the user group (USER), the scientific assessors with affiliation to organic farming research (ORG+) and the scientific assessors without affiliation to organic farming research (ORG-). Before peer reviews were analyzed, ratings were averaged within each group.

Statistics

The present study may be viewed as a review reliability study, where multiple but not all assessors review each grant application. The assessors who evaluate each application typically differ and the number of ratings of each application differs too. In such studies, peer review reliability is defined as the relation between two sets of independent ratings for a large number of submissions (Marsh and Bazeley, 1999). In this study, reviewers are categorized in three groups (ORG+, ORG- and USER), which means that data is analyzed as three assessors' peer reviews of all grant applications. Although there is a variety of statistics used for estimating the reliability of ratings, the most highly recommended are the Kappa and Pearson correlation coefficients, which are equivalent under appropriate conditions (Cicchetti, 1991b). Kappa statistics are appropriate for testing whether agreement exceeds chance levels for binary ratings. The value of Kappa is an index of agreement, often refereed to as reproducibility or reliability (Thompson and Walter, 1998). Because rank-ordered evaluative scales were used and not dichotomous scales such as "good" or "poor", weighted Kappa statistics were applied (Cicchetti, 1991a). In Kappa statistics only integers was used to create graded levels in the range of 1 to 6. According to Cicchetti (1991a), correlation coefficients and Kappa values less than 0.4 indicate poor agreement of peer reviews; 0.40-59 fair agreements; 0.60-0.75 good agreements and 0.75-1.00 excellent agreements. Cicchetti's terminology is used throughout the paper.

To test differences between rating levels between assessor groups, analysis of variance was performed.

Results

Scientific assessors with affiliation to organic farming research (ORG+) rated the average scientific quality higher than assessors without this affiliation (ORG-) ($P < 0.01$) and the 16 funded projects were generally rated higher than the not funded projects (Table 1). The user group (USER) rated relevance significantly lower than both scientific groups (P < 0.001) and it differentiated ratings more (Tables 2 and 3).

Statistic analyses showed total lack of agreement between the two scientific groups with respect to the assessment of relevance and presentation of problem (P), poor agreement on methodology (M) and fair agreement on the applicants' qualifications (Figure 1). Scientists with affiliation to organic farming (ORG+) showed much higher agreement with the user group on relevance ($r=0.46$, $P<0.001$) than scientist without this affiliation ($r=0.28$, $P<0.05$) (Tables 2 and 3). Some projects, however, were assessed highly relevant by scientists with or without affiliation to organic farming and not relevant by users and vice versa (Tables 2 and 3). If the scientific groups' assessments of relevance were substituted with total quality ratings (scientific quality + relevance), Tables 2 and 3 remained more or less unchanged because assessment of relevance and scientific quality was highly correlated within each scientific group (P < 0.001) (Tables 4 and 5).

The varying degrees of agreement on the scientific quality criteria and the total lack of agreement on relevance resulted in a poor but statistically significant agreement on the total quality ratings (scientific quality +relevance) (Figure 1).

At a common meeting between the scientific committee and the user group, one could get the impression that the user group evaluated the relevance of the grant applications in the perspective of the quality of the grant application as a whole. The user group seemed not to be specific about the demarcation between relevance and scientific quality. It was, however, not possible to test whether the user group rated the societal relevance of the grant applications independently of the scientific quality, because the user group was only asked to evaluate relevance. In the scientific committee, however, data clearly showed, that both scientific groups did not clearly discriminate between scientific quality and societal relevance (Tables 4 and 5). Strong correlations existed between scientists' ratings of scientific quality and relevance in both groups. The ratings of the individual scientific quality criteria (P, M, Q) also appeared to be highly inter-correlated. The total ratings (scientific quality + relevance) within each scientific group more or less equaled the ratings of the scientific quality, indicating that the assessment of relevance did not add much to the scientific quality assessments in the total quality assessment.

Poor agreement or even disagreement between the scientific groups was in particular obvious for the projects, which were funded (n=16). For these projects, correlation analysis showed that ratings from the user group (relevance) and the scientists without affiliation to organic farming (ORG-) (scientific quality + relevance) were negatively correlated ($r=-0.519$, $P < 0.05$), whereas the user groups' ratings were positively correlated with the ratings from the scientists with affiliation to organic farming ($r=0.597$, $P < 0.05$). There was no correlation between the scientist groups' ratings ($r=0.04$, $P > 0.05$).

Analysis of individual reviewers' ratings showed that there was good agreement between leading experts' total ratings and the remaining assessors ($r=0.643$, $P < 0.001$) (data not shown). Leading experts, however, rated high rated projects higher than the remaining assessors and low rated projects lower. Hence, leading experts were more positive to high quality projects and more negative to low quality projects than the remaining assessors.

Discussion

This study showed poor agreement between assessor group ratings with respect to all criteria expects applicants' qualifications, which showed fair agreement (Figure 1). Other studies support that it is easier to agree on scientific qualifications than on application content (Marsh and Bazeley, 1999). Scientific qualifications seem to be evaluated in a more objective and reproducible way than other quality criteria related to peer review of grant applications. Scientific qualifications are first of all evaluated on the basis of the scientists' track records (e.g., published output and academic status). Some peer review studies show that publication output and academic status (level of appointment and institutional base) is higher for successful grant applicants than for unsuccessful (Bazeley, 1998) but other studies could not support this finding (Cole et al., 1981).

In general, peer review studies show substantial reviewer variance and thereby poor agreement between different reviewers of grant applications and manuscripts (Cole et al., 1981; Cicchetti, 1991a; Rothwell and Martyn, 2000). Cole et al. (1981) found that roughly half the fate of a particular grant application was determined by characteristics of the application and the applicant, and the other half was determined by apparently random elements, which they called the “luck of the reviewer draw”. As a parallel to grant applications, Rothwell and Martyn (2000) found agreement between reviewers as to whether manuscripts should be accepted, revised or rejected, which was not significantly greater than that expected by chance.

Given the significant importance of chance in peer review of grant applications, Cole et al. (1981) confirmed that the more applications a researcher submits the higher the probability of being funded. This means that the probability of getting a research grant is highly dependent on the number of submitted applications.

Poor agreement between reviewers in a committee may originate from random or systematic disagreement among reviewers. If there is substantial random disagreement among a population of reviewers, then it would be possible for unbiased groups of reviewers to differ in the mean rating, simply by chance (Cole et al., 1981). Systematic biases may originate from disagreements between scientific schools of thought and/or societal discourses and other kinds of disagreements based on personal knowledge, issues of gender, nationality and personal preferences.

Bias in peer review and selection of reviewers has been debated within a number of research disciplines (Travis and Collins, 1991). The most common complaint is of bias against lesser know institutions and unorthodox research, particularly from the so-called old-boys network. This is called cognitive cronyism or “old boyism”. It is uncertain how widespread it is, but interdisciplinary research and areas of controversy are more likely to suffer from cronyism than mainstream research (Travis and Collins, 1991; Luukkonenen, 1995). The consequences is that unorthodox projects are less likely to be funded and that applicants will try to play down the novel aspects of their applications – or even change their research intentions (Travis and Collins, 1991). This may support conservatism and undermine the culture of risk taking. In highly competitive research environments, however, jealousy rather than cronyism may be the problem (Wessely, 1998; Wilson, 2002). Top-rated research groups seem not to favor applications from similarly prestigious groups, and there are examples, which show, that they may tend to disfavor them (Wessely, 1998).

It is evident that non-rational aspects may interfere in the review process. One study clearly showed that women applicants of postdoctoral fellowships received lower review scores than their male counterparts even if they were just as qualified (Wennerås and Wold, 1997). Biases in the perspective of gender have been intensively debated and literature is ambiguous on this issue (Bazeley, 1998; Wessely, 1998).

There are no published studies on the reproducibility and systematic biases of peer reviews of organic grant applications or scientific manuscripts. In this study, the way reviewers were selected influenced peer reviews. Assessors with affiliation to organic farming (ORG+) reviewed grant applications differently from those assessors without this affiliation (ORG-). Whether this bias is linked to the alternative-dominant paradigms is not possible to clarify on the basis of the present investigation. It is, however, most likely that assessors with comprehensive research experience in organic farming are more oriented towards the alternative paradigm than assessors without this experience, because people in general strive for harmony between their paradigmatic positions and actions. Rasmussen and Kaltoft (2003) showed that university staff's attitudes were reflected in their professional engagement in organic farming.

The present study is not able to explain why assessors with affiliation to organic farming were more in agreement with the organic farming sector than the assessors without this affiliation. Lockeretz (2000) concluded that the main difference between organic and conventional farming research is what gets studied, not in how one studies it. This could be an argument for separating quality criteria in the review process into two categories; (1) relevance (what gets studied) and (2) scientific quality (how one studies it) as it was the case in the present research program. This study, however, showed that the two categories of quality were indeed very difficult to distinguish in practice. Ratings of scientific quality and relevance were highly correlated.

There was even a surprisingly high correlation between the ratings of the qualification of applicant(s) and the societal relevance of the grant applications (Tables 4 and 5). One should expect that less qualified scientists could propose relevant research projects and vice versa, and that these ratings would therefore be uncorrelated, but this was not clearly reflected in the peer reviews. Actually, the relevance marks, seemed not to add anything substantial to the scientific quality assessments due to inter-correlations between all assessment criteria. This, however, does not mean that relevance is unimportant. Most likely, it is very important and it could be hypothesized that the perception of relevance influences the scientific quality assessment. It is, however, not possible to reveal causality in the present study.

This study challenges the idea of an objective science. The contextual values, which are associated with the traditional norms of good agriculture, were not distinguished from the constitutive values of science, which are associated with the norms of good science (Longino, 1990: 4). In the dominant knowledge and learning paradigm, the constitutive values of science are assumed to be unaffected by the contextual values, which are excluded from the research process.

In the alternative knowledge and learning paradigm, contextual values are considered to enter into the very process of science. Therefore, Alrøe and Kristensen (2002) suggested reflexive objectivity as a new criterion for doing good research. This criterion includes and exposes the role of value-laden aspects in research. It implies both an involved actor stance, where contextual values influence specific research processes, and a detached observer stance, which enables a distinction between normative and empirical aspects of science and a scientific communication of the value-laden context. Alrøe and Kristensen (2002) linked relevance of science to the contextual values and reflexive objectivity to the constitutive values in their philosophical analysis.

If the constitutive values of science are unaffected by contextual values (the dominant position), the assessment of scientific quality should be independent of the assessors' paradigmatic positions and it should be unimportant whether research is directed towards organic or conventional agriculture. The norms of good science should rise over value-laden contexts. Opposite, if the value-laden contexts influence the constitutive values of science (the alternative position), the demarcation line between science and its value-laden contexts is complex and the concept of reflexive objectivity as proposed by Alrøe and Kristensen (2002) would be valuable. Paradigmatic position may show up as an influential factor in the assessment of scientific quality and an open communication of value-laden intensions to expose the role of value-laden aspects in research is needed. Scientists with positive attitudes towards conventional mainstream agriculture may hold other scientific quality norms than scientists with positive attitudes towards organic farming as this study indicates.

This empirical study supports the alternative paradigmatic position, which acknowledges that the norms of good science may be linked to societal relevance, the contextual values. In this perspective, contextual values should not be excluded from the peer review process but subjected to open communication within the scientific world. The assessors’ engagement in organic farming may be important in the review process, and the best way to handle this “problem” is an open communication of the value-laden intensions and different views on scientific quality.

The decision taken by FORMAS to have two complementary groups of scientists in the committee to ensure balance and broadness in perspectives appears sound in this perspective, if the research program should comply both with the requests from the scientific establishment, represented by the scientists without affiliation to organic farming research (ORG-), and the scientists with affiliation to organic farming (ORG+). It could, however, be debated whether this balance is required if the scientists with affiliation to organic farming are equally scientifically qualified compared to the representatives from the scientific establishment. If this requirement is fulfilled, it could be argued that there is no need of representatives from the scientific establishment. This, however, is a debate, which should be taken in research councils.

In conclusion, this study shows that assessors’ affiliation to organic farming may create systematic biases in the peer review process of organic grant applications. In this study, assessors who were experienced in organic farming research were more in agreement with the users of the research concerning the relevance of grant applications than assessors without this experience. Regardless of the affiliation to organic farming, assessors did not clearly distinguish between societal relevance and scientific quality of the grant applications. The contextual values seemed to enter into the very process of science.

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TABLE 1

Average ratings (standard deviation in parentheses) of scientific quality (P+M+Q) and relevance of grant applications reviewed by scientists without (ORG-) and with (ORG+) affiliation to organic farming research and user the group (USER). Rating 1 is poor and 6 are excellent. P denotes the presentation of problem, M denotes methodology, and Q denotes qualifications of the applicant(s).

Category of grant application		N	Rating		
			Scientific quality (P+M+Q)	Relevance	Total rating (scientific quality + relevance)
All	ORG-	84	3.48 (0.90)	3.50 (0.81)	3.47 (0.81)
	ORG+	84	3.78 (0.81)	3.71 (0.79)	3.72 (0.74)
	USER	84	-	3.07 (1.58)	
Funded	ORG-	16	4.20 (0.81)	4.01 (0.61)	4.15 (0.67)
	ORG+	16	4.31 (0.76)	3.96 (0.82)	4.23 (0.74)
	USER	16	-	4.07 (1.23)	

TABLE 2

Frequencies of ratings of relevance of grant applications assessed by scientists without affiliation to organic farming research (ORG-) and user group (USER). Rating 1 is poor and 6 are excellent. Statistics showed “poor agreement”.

		USER						
	Rating Groups	1	2	3	4	5	6	Total
	1	1	0	0	0	0	0	1
	2	4	1	1	1	1	0	8
	3	6	4	6	3	6	0	25
ORG-	4	7	6	13	8	6	3	43
	5	2	0	1	1	1	2	7
	6	0	0	0	0	0	0	0
	Total	20	11	21	13	14	5	84

TABLE 3

Frequencies of ratings of relevance of grant applications assessed by scientists with affiliation to organic farming research (ORG+) and user group (USER). Rating 1 is poor and 6 are excellent. Statistics showed “fair agreement”.

		USER						
	Rating groups	1	2	3	4	5	6	Total
	1	0	0	0	0	0	0	0
	2	2	0	1	0	0	0	3
	3	11	2	7	2	1	0	23
ORG+	4	4	8	9	7	10	3	41
	5	3	1	4	4	2	2	16
	6	0	0	0	0	1	0	1
	Total	20	11	21	13	14	5	84

TABLE 4

Correlations between scientific quality criteria (P, M and Q), relevance and total rating for all 84 grant applications peer reviewed by scientists with affiliation to organic farming research (ORG+).

P denotes the presentation of problem, M denotes methodology, Q denotes qualifications of the applicant(s) and total is the sum of scientific quality and relevance.

	M	Q	Scientific quality (P+M+Q)	Relevance	Total
P	0.575***	0.502***	0.802***	0.624***	0.837***
M		0.710***	0.875***	0.397***	0.833***
Q			0.869***	0.347**	0.811***
Scientific quality (P+M+Q)				0.515***	0.969***
Relevance					0.707***

Significant at ** p<0.01; *** p<0.001.

TABLE 5

Correlations between scientific quality criteria (P, M and Q), relevance and total rating for all 84 grant applications peer reviewed by scientists without affiliation to organic farming research (ORG-). Symbols as in Table 4.

	M	Q	Scientific quality (P+M+Q)	Relevance	Total
P	0.861***	0.640***	0.895***	0.666***	0.888***
M		0.671***	0.910***	0.529***	0.875***
Q			0.861***	0.359***	0.811***
Scientific quality (P+M+Q)				0.549***	0.976***
Relevance					0.701***

Significant at *** p<0.001.

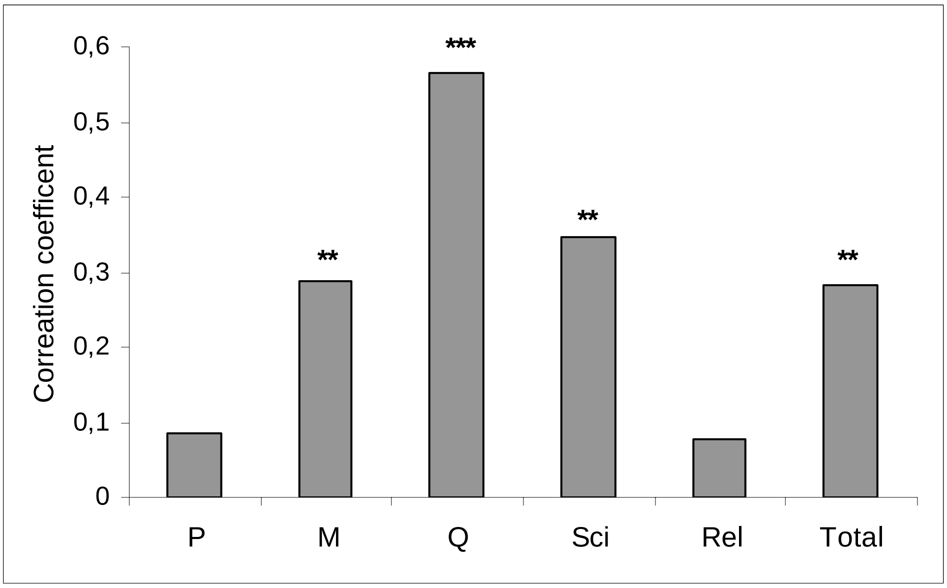

FIGURE 1. Correlation of ratings from scientists without (ORG-) and with (ORG+) affiliation to organic farming research (n=84). P denotes the presentation of problem, M denotes methodology, and Q denotes qualifications of the applicant(s). Sci is the sum of P, M and Q, Rel is the societal relevance and Total is the sum of all quality criteria. Significant at ** $p<0.01$; *** $p<0.001$.

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