PEER REVIEW OF GRANT PROPOSALS: THE SAUDI ARABIAN EXPERIENCE

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ABSTRACT. The process of peer review, as adopted by King Abdulaziz City for Science and Technology (KACST) is breifly described. From the peer review data analysed, it was shown that there are small, but clear, differences between reviewers of different scientific fields. Although these differences were found to be statistically insignificant, it was felt that the situation warrants more investigation to clarify this point. A strong relationship was found between the reviewer's judgement on the scientific and technical merit of the project and the other variables under study, namely , the project quality , management, applicability and the capability of the researchers. It was also found that the project quality has the highest effect on the reviewer's assessment of the project merit, while the researcher's capability has the lowest effect.

1. INTRODUCTION

When applied to research, peer review is defined as " the evaluation of the conceptual and technical soundness of research by those qualified to judge it by their status in the same or closely related research fields " [1]. The adoption of this mechanism for the assessment of research proposals, scientific programs and researchers is based on the idea that scientific peers, by virtue of their experience and knowledge, are most capable of critically examining proposed or completed research projects and giving scientific points of view about the merit, significance and feasibility of those projects [1], and that they generally agree on the definition of " good science" [2].

Although there is a host of evaluation techniques for the scientific research activities, peer review has gained popularity in many research agencies world-wide

In Europe, for example, the European Economic Community (EEC) uses either a panel of external independent experts or hearings for the evaluatin of R & D programs. The first procedure deals with the scientific and technical achievements of R & D prgrams, their input into social and economic development as well as the efficiency of the organizaiton and leadership. Hearings, on the other hand, are used in the evaluation of the national inter-laboratory activities[2].

Another version of peer review was developed by the Swedish National Science Research Council and was used in Sweden as well as other neighbouring countries (Finland, Norway and Denmark). It aims at the evaluation of basic research fields competing for public funds. A team of four to six evaluators (foreign peers) meets once to interview the researchers and get aquainted with the research facilities. Emphasis is put on the general level of the work performed, structural and organizational problems[2].

Peer review is the primary method of evaluation when the Australian Research Council deals with reasearch in humanities and social sciences. Criteria examined are the potential advance, and the quality of both the research and the researchers[3].

Peer review is also used, in different versions, in the U.S.A., by agencies like the National Science Foundation (NSF), the National Academy of Science and the National Institutes of

Health (NIH) [3]. The NSF model is of a special interest, since a variant of it is applied in Saudi Arabia. This model, adopted by KACST, is briefly described below.

2- THE PEER REVIEW PROCEDURE

Peer review is involved in all stages of the project execution. The first stage involves the review of proposals in the light of certain criteria and with the purpose of selecting the proposals that are most worthy to be funded. Criteria considered deal with the scientific and technical merit of the proposed research project, chances of success , soundness of the project structure and the investigators' capability in terms of their educational background and research experience. Because of the vitality of this stage to both researchers and KACST, since it solely affects decisions on fund allocation, special attention is given to the selection of reviewers. In recent programs the number of reviewers is confined to four or five for each project.

The second stage of peer reviewing deals with the evaluation of ongoing research. Again, each funded project is assigned a group of three to five reviewers whose task is to evaluate the progress of work through periodic progress reports. This group is chosen, most of the time, from that of the first stage. The last stage is usually a one-shot assignment for the evaluation of the final report to assess, not only its publishability, but also the extent of achieving proposed goals at the project conclusion.

Peer review played, and is still playing, a significant role in helping with the efforts of establishing and promoting the research community in Saudi Arabia. Problems that are universally recognized as inherent in the system are kept to the minimum through selection criteria and careful management. Some of these problems are the bias and conflict of interest that usually occur in few and isolated cases , and the absence of evaluating the social effects or judging the social relevance of scientific research . With time, and the fact that the need for careful planning and more diligent resource allocation is becoming more persistent, the need also arises for looking , scientifically, both into the future and the results of what was done.

To gain more insights into the process of peer review, data from the Seventh Program (1405H) was analysed and some characteristics of the mechanism were arrived at.

3. PEER REVIEW DATA

Till 1414H KACST funded fourteen annual programs with the total of 337 projects in different fields, and the cost of about 290 million Saudi Riyals. Also fourteen national projects were funded at a cost of 95 million Saudi Riyals[4].

The Seventh Program data were considered because of the number of cases (192 proposals) that warrants a more reliable analysis. The number of reviewers was, on the average, five in each project. Results were tabulated for their response to the following :

- The capability of the research team.
- The quality of the project.
- The management plan of the project.
- The applicability of the results.
- The scientific and technical merit of the project.

For each issue the reviewer's response was numerically recorded from a scale of 10. The proposals were distributed among four scientific fields , engineering (with 80 proposals) , medical sciences (64), agriculture (26) and basic sciences (22). Engineering projects were about 40% of the total number. This conforms with the percentage of the total number of engineering projects to the total number of projects in the programs funded so far. The statistical package (SPSS) was used in the analysis .

4. ANALYSIS AND DISCUSSION

The five factors under study ranged in average from 5.9 to 6.9 for all fields as shown in Figure 1 . The differences between these averages seem to be statistically insignificant . This

was also clear from the T-tests that were run for comparisons of variables from the fields of medicine and engineering in one run, agriculture and basic sciences in another and basic sciences and medicine in the third run. However, because of the relatively large number of data, it sounds appealing to consider a comparison of the different factors in this figure.

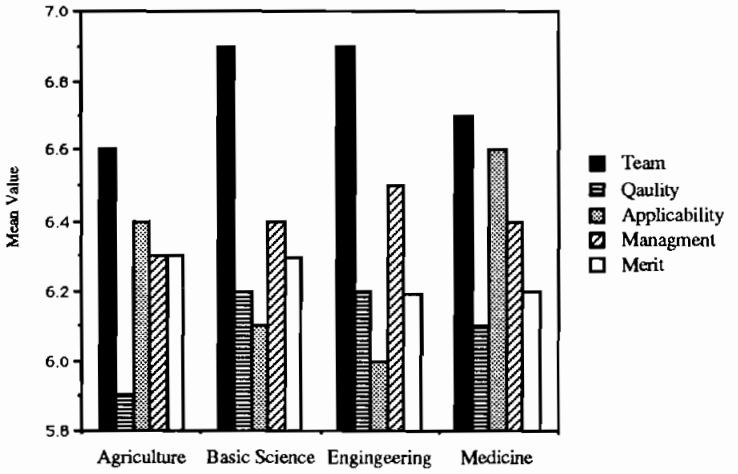

Figure 1: Distribution of Means of Review Variables in Each Field

Peer reviewers in the agricultural field tend to be more conservative in evaluating the capabiliteis of their peer researchers as well as when evaluating the quality and the management of the project, whereas they tend to look favourably to both the applicability and the technical and scientific merit of the projects.

In engineering, as another example, the situation seems to be the opposite. The liberal look is towards the team capability, the project quality and management , while the applicability and the merit of the project are given relatively lower grades on the average.

Peer reviewers of the basic sciences field are similar to those of the field of engineering in all factors except when it comes to the scientific and technical merit, in which they behave like the reviewers of the agricultural field. The medical reviewers are in between values except for project applicability, where they have given the highest scores.

It is assumed in this process that the idea formed about the technical and scientific merit of the project comes as a result of the information gained about the other factors, namely the team capability , the project quality, the management plan and the applicability of the project results. Hence, the project merit is correlated to the other variables. Figure 2 is a scatter plot matrix that shows an indication of this correlation. In this figure, the name squares, that occupy the diagonal of the matrix identify the coordinates of the plot squares, as usual. This means that every row has the same ordinate, the name of which appears in the name square, and also every column has the same abscissa with the relevant name square.

This assumption was adopted in a linear regression exercise, in which all factors were considered as indepedent variables except for the technical merit which was singled out as the dependent variable. The technique used regressed the most promising independent variables according to their contribution towards the model improvement.

The table below shows this process . The improvement in model is shown through the improvement of the coefficient of regression (r^2):

	Variable	Coeff. of regression (r^2)
(a):	Management	0.5956
(b): (a) +	Quality	0.7047
(c): (b) +	Team capability	0.7077
(d): (c) +	Applicability	0.7238

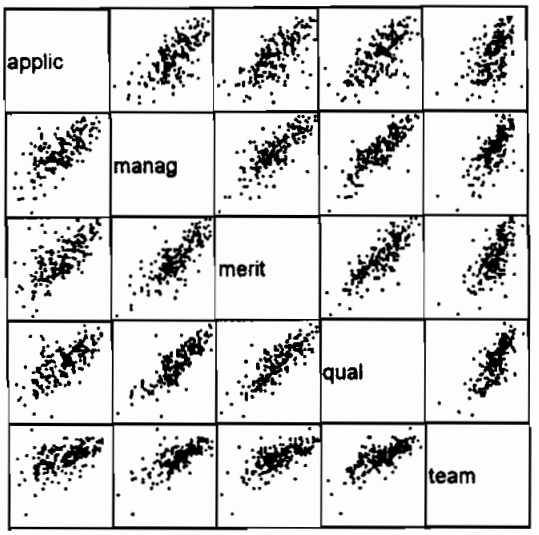

Figure 2 : A scatter Plot Matrix of Review Variables

Figure 3 shows a relationship between the cumulative percentages of the observed and the expected standardized residuals. The near-fit to the normal line is an indication of the close representation of the observed data to the linear model.

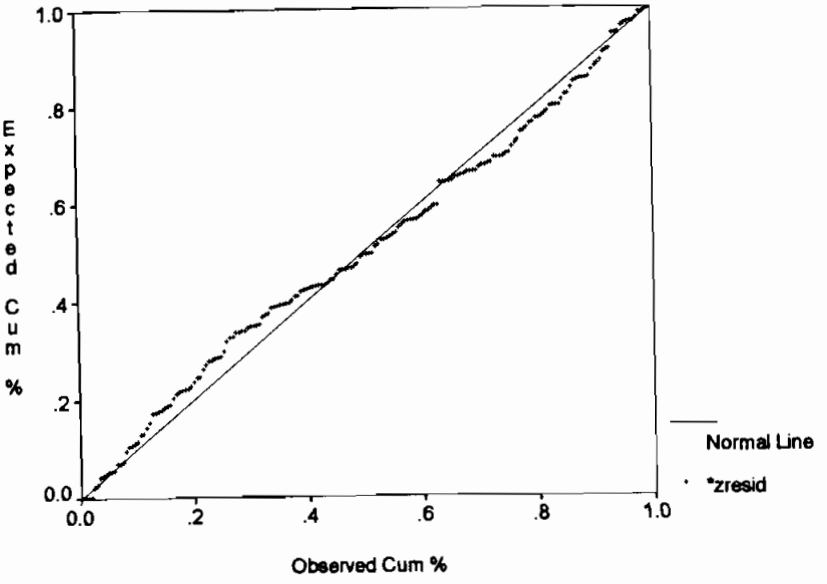

Figure 3 : Normal Plot of Regression Standarized Residual (*zresid)
Dpendent Variable : Merit

The high correlation of independent variables, apparent from Figure 2, was further confirmed by the correlation matrix shown in Table 1. The clear multicollinearity, however, is not expected to affect our analysis since the range of observations is not exceeded [5].

Table (1) : Correlation Matrix for the Independent Variables

	Applic.	Manag.	Qual.	Team
Applicability	1	0.3371	0.2868	0.0909
Managment	0.3371	1	0.5087	0.4021
Quality	0.2868	0.5087	1	0.4251
Team	0.0909	0.4021	0.4251	1

Our regression equation is :

$$y = 0.153 + 0.106\,\chi_1 + 0.158\,\chi_2 + 0.211\,\chi_3 + 0.490\,\chi_4 \qquad (1)$$

where y = project merit

χ_1 = team capability.

χ_2 = project applicability

χ_3 = Project managment

and χ_4 = project quality

Due to the multicollinearity of the independent variables, inferences should be made with the context of all those variables in the model. Given that, the project quality has the greatest effect in the reviewer's assessment of the project merit. Close to 50% of the reviewer's decision can be attributed to this variable.

The project management comes next, followed by the project applicability and the team capability respectively.

The impact of the project quality on the reviewer's judgment about the project merit may be further confirmed with the comparison of the standardized regression coefficients (the beta coefficients). These coefficients are purposely developed to facilitate this type of comparison [5]. These are shown in Table 2 below.

Table (2) Regular and Standardized Coefficients of Equation (1)

Variable	Coefficient	
	Regression	Beta
Management	0.211	0.200
Quality	0.490	0.464
Team capability	0.106	0.097
Applicability	0.158	0.182

Although the previous hierarchy is not changed, a further setback is noticed for the team capability. This is interesting, since the contribution of the team capability to the scientific and technical merit of the project was expected to be more significant.

5. CONCLUSION

The analysis of the data at hand draws a somewhat coherent profile of the process of peer review in the Kingdom. The main characteristics of this profile are:

Evaluation factors considered differ in value from one field to the other . Although the differences observed are not large, and moreover, their means seem to come from the same population, it is felt that they show a likelihood of trend. Further analysis is needed to confirm our postulation.

The reviwer's decision on the scientific and technical merit of the project tends to be systematically influenced by his assessment of the other variables of project management, quality , applicability and the capability of the research team.

Most of this influence may be attributed to the reviewer's feeling about the project quality.

The capability of the research team seems to have the least significance in the reviewer's decision.

No claim was made on the reviewer's awareness of these influences.

This work constitutes the beginning in our effort to gain more understanding of the mechanism of peer review in the Kingdom. More work is required towards investigating the inter-relationships of parameters constituting the process of peer review.

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