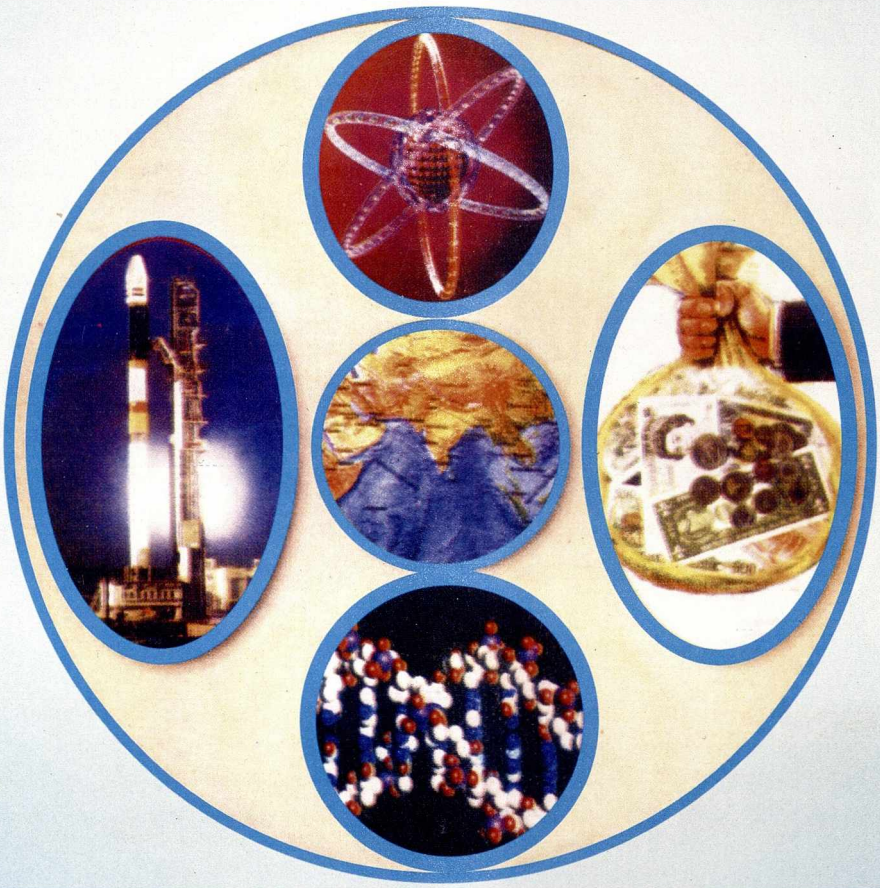
ENHANCING TRANSPARENCY OF PEER REVIEW IN R & D FUNDING

DECEMBER – 2008, NEW DELHI

Sponsored by

सत्यमेव जयते

DEPARTMENT OF SCIENCE & TECHNOLOGY
MINISTRY OF SCIENCE AND TECHNOLOGY
GOVERNMENT OF INDIA



FINAL REPORT

Prepared by

WiTT WATERFALLS INSTITUTE OF TECHNOLOGY TRANSFER
NEW DELHI

ENHANCING TRANSPARENCY OF PEER REVIEW IN R&D FUNDING

DECEMBER – 2008
NEW DELHI

Sponsored by

DEPARTMENT OF SCIENCE & TECHNOLOGY
MINISTRY OF SCIENCE AND TECHNOLOGY
GOVERNMENT OF INDIA

FINAL REPORT

Prepared by

WiTT

WATERFALLS INSTITUTE OF TECHNOLOGY TRANSFER
NEW DELHI

CONTENTS

PREFACE

PREFACE

The Government of India has set up an impressive S & T infrastructure in the country that is engaged in technology development and transfer. Starting with very modest allocations for Science & Technology in the early years after independence, the current expenditures on R&D in the country involve substantial amounts. Nature of R&D involves both basic research or fundamental research and also applied research. As for funding of research one of the universal and fundamental principle of good and sound governance is its transparency. The importance of 'Transparency in R&D Funding' needs hardly any elaboration in view of the central agencies investing huge funds in R&D for promoting Science & Technology on annual basis. The objective of transparency in Research and Development has to be the creation of a system of allocation of funds that will promote, support and sustain R&D and maximize its outcomes.

Keeping above in view, a workshop on Transparency in R&D Funding was organized on 21st March 2006 by Waterfalls Institute of Technology Transfer under the auspices of Department of Science & Technology, Ministry of Science & Technology, Government of India. The workshop included a galaxy of prominent persons, all experts in their respective fields spanning planning, funding, vigilance, law, finance, management and so on.

The workshop provided valuable leads for framing of guidelines on transparency in R&D Funding and Monitoring. One of the important thing that emerged is, that concept of 'Peer Review' occupies a central position in R&D Funding. Peer review is a system whereby research or a research proposal is scrutinized by independent experts (peers). In general the process serves a technical and a subjective function. Peer review, in fact, is the name of the process by which the work and ideas of an individual or group is assessed. Thus the reviewers are deemed to be the "peers" of the assessed. The purposes of peer review are to inform decisions either on the allocation of funds among a number of applicants

known as "research grant agency peer review" or on the publication of the result known as "editorial peer review".

It is however felt that known methodology of standard 'Peer Review' no doubt works but is not the best. It has been there in the absence of any other better mechanism. There are opinions for and against the mechanism as at present. Sometimes lack of confidentiality in the system of peer review prompts the peer not to give their complete or honest opinion. Above all, the quality of the peer group that is engaged for required analytical and justified discrimination is perhaps the most important. Equally important is the absence of bias in the peer group, something very difficult to find, call it human strength or call it human weakness. However, in the peer review system bias of any kind other than the bias of quality of scientific judgment is lethal. It is therefore felt necessary to ensure that the peer process that is set up is free from conflict of interest in order to get an unbiased opinion.

Since results of research funding are hard to quantify, research agencies rely on peer assessments, either prospectively or retrospectively, to justify and evaluate their performance. Peer review is proposed to be entirely retrospective and concerned with past performance relative to funds received. Prospective view, concerned solely with budget is proposed to be performed inhouse by the funding bodies.

It is easy but dangerous to become complacent about a system. A need is felt to constantly innovate and to look at overselves quite critically. System of grant of applications has to ensure that researchers are encouraged to complete and document their work, careful planning is fostered, the work is subjected to scientific criticism and, if necessary budget can be trimmed to suit the work. Study of underlying reasons for the system as it exists and preservation of these in alternative models is called for.

In view of what is stated above and further due to the fact that the concept of "Peer Review" and more importantly 'Fair Peer Review' in R&D Funding is gaining more & more importance globally, it was found to be worth while to conduct a deep study of 'Peer Review' systems adopted in few important countries where large sums are involved in R&D Funding to dig out the required reforms which would assist in improving the transparency of peer review system in India.

Proposal with regard to above submitted by Waterfalls Institute of Technology Transfer to Department of Science & Technology, Government of India was accepted and the project was assigned, to WITT in the middle of the year 2007. Subsequently required data for Enhancement of Transparency of Peer Review in R&D Funding' and as stipulated under the scope of work were collected from different appropriate sources.

It broadly involved collecting of latest data and procedures followed by lending R&D Funding Agencies in India and abroad through published literature and also through a questionnaire issued to them. Relevant material on the subject was also downloaded from Internet.

As a measure of further analysis of collected data, same was suitably processed and arranged in specific order for preparation of draft report. The Draft Report, as prepared above, was circulated among large number of Government agencies / departments and also some outside experts for their study and also to encourage better interaction among participants in the Interactive Meet held on 18th September, 2008 at India International Centre, New Delhi. List of participants is enclosed as Annexure IV. Participation in the 'Meet' has been very encouraging and the proceedings of the same are forming part of Observations and Conclusions of the Final Report.

While going through the above materials, repetitions of few contents may be found here and there which are found to be unavoidable, to make the contents more explicit and complete in all respects.

The Institute is very thankful to the Department of Science & Technology (in particular Dr. Laxman Prasad) for their efforts in identifying the importance of this subject and assigning the same to WITT. The Institute wishes to place on record its appreciation to several agencies in India and abroad, whose reports and publications have been found very much stimulating in the formatting of this Report. Institute is also thankful to the participants in the Interactive Meet and their valuable contribution in finalization of this action oriented Report.

New Delhi
December 2008

Dr. K.V. Swaminathan
Chairman

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Peer review is the name of process by which the work ideas of individual or group is assessed by another individual or group considered to have a level of expertise near to that of assessed. Thus the reviewers are deemed to be the peers of the assessed. The purposes of the peer reviews are to inform decisions either on the allocation of funds among a number of applicants (research grant agency peer review) or on the publication of result of research (editorial peer review). The peer review system is one of the most firmly entrenched institutions in academia, widely accepted as the best way to deal with research funds.

Most within the research community consider the merit of peer review as an article of faith but is it really the most equitable and impartial way to distribute scarce research funds. Some, however, argue that peer review if biased and inefficient, stifles true innovation. Others claim it has its place, but should not be the sole method for deciding who gets funded. Defenders of peer review admit it is not perfect but it is by far the best imaginable system.

Another opinion says that Peer Review works very well for large, well established systems of research. It does not work as well where something is developmental, inter disciplinary, innovative or at the cutting edge. The growth in funding opportunities is a good thing for researchers but is a tremendous burden for reviewers.

The biggest flaw with the current system is found to be its winner-take-all nature i.e. a proposal that scores just above the cut off point receives funding, but one that falls just below receives nothing. It is unlikely able to discriminate which of the two nearly equal proposals is truly better and hence the nil' award may be counter productive.

A sound fund allocation policy will necessarily involve a subset of values and regulations that will ensure on efficient matching of resources and objectives

achieved over a specified period. As an exercise towards achieving the best required goals, relevant material has been collected in India and also the practices as existing in various other countries specially these with comparatively large involvement of funds, about the transparency in R&D Funding and Peer Review. These have been grouped under various broad heads such as. Introduction, Practices in other Countries, Science & Technology Audit, Existing Practices in India, Allied Significant Factors in Peer Review, Present and Future State of Peer Review and finally Observations and Conclusions. These are briefly summarized as below: Also included are few relevant and worth-while annexures on the subject.

(A) INTRODUCTION

Introductory chapters under this have five heads namely (A1) Peer Review in General, (A2) Peer Review a tool for Cooperation and Change, (A3) Scientific Peer Review, (A4) The Arbiter of Scientific Quality, Manuscript Peer Review and (A5) Peer Review Systems for Government Sponsored Research.

(A1) Peer Review in General - Since Peer Review is found to be a process of subjecting an author's scholarly work or ideas to the scrutiny of others who are experts in the field, focus is laid on its methodology, selection of reviewers, ways of review, criticism of process, system failures, frauds followed by dynamic/open peer review for the sake of enhancement in Transparency.

(A2) Peer Review-A Tool for Cooperation and Change- Above study conducted sometime back examines the practice of Peer Review and the related effect of peer pressure in the context of international organizations particularly the OECD. It outlines the main features of these two concepts and attempts to establish a model based on the different peer review mechanisms used at OECD. These create a catalyst for performance enhancement which can be far-reaching and open-ended.

(A3) Scientific Peer Review- Considering the possible failings of peer review, and the potential for bias and abuse of the process, certain principles as outlined, for conduct might help to minimize problems while maintaining the advantages. Also outlined are certain rules and guidelines that should be followed by peer reviews for quality and transparency.

(A4) The Arbiter of Scientific Quality-Manuscript Peer Review - Sense about Science - a charity devoted to the promotion of evidence based approaches to scientific issues believes that peer review is one essential arbiter of scientific quality and that information about the status of research results is as important as the findings themselves. It has produced a timely guide to the whole process simultaneously listing the challenges for peer review.

(A5) Peer Review Systems for Govt. Sponsored Research- The peer review systems adopted for government approved research funding can be roughly sorted out into two types. One type was first adopted by the office of the Naval Research (ONR) and the National Science foundation (NSF); the other type was that introduced by the National Institute of Health (NIH). ONR-NSF system places greater responsibility on the individual program manager, funding is handled by a single NIH institution called the Division of Research Grants.

(B) PRACTICES IN OTHER COUNTRIES

Country-wise data of major countries on the aspect of Peer Review and its Transparency are grouped under this head. Also included are the relevant analyses wherever called for. Country-wise material, in brief, is as under;

(B1) British Academy Policy on Peer Review and Grants- The Peer Review process used to assess research grants applications are similar in many respect to those for publication. Procedures adopted by Arts of Humanities Research Council (AHRC), and by Economical Social Research Council (ESRC), for Peer Review of large grants are listed. Also included are British Academy peer review

process which itself is a research funder. Special inclusions are few examples of good practice and also the transparency of peer review practices.

(B2) Peer Review in UK- Education, Research and Development Directorate, North Bristol, U.K has very recently come out with revised version of R&D Policy and Scientific Peer Review. Observations made there-in are expected to result in reasonably fair and transparent review which can be useful and principles can be applied for various scientific fields in Research and Development. Information regarding the peer review undertaken for a study, is held on the R&D office Research Projects database and is included in the audit/monitoring of studies covered by a separate policy.

(B3) Peer Review Mechanism for Funding Medical Research CANADA- The steps involved for any researcher wishing to undertake research and apply for research funds include development of the concept, completion of an application, institutional review and granting agency review. For the sake of increased transparency, review processes in Canada and also to ensure the optimal utilization of research are clearly outlined. Mechanisms are reported to use the limited funds efficiently and encourage scientific thinking and methodology in Canadian researchers.

(B4) Peer Review Experiences in Japan- RyOkichi Hirono, professor emeritus, Seikei University has covered above topic in detail in a recent paper in Jakarta. Outlines of the topics broadly covered are introduction, history of OECD (Organization for Economic Cooperation and Development), peer review in Japan, its mechanism major findings and some salient impacts of OECD peer reviews, merits of OECD PR process and lastly some lessons for non-member countries from OECD peer review mechanism.

(B5) Policy Mix Peer Reviews (Sweden, Romania, Spain)- The Policy Mix Peer Review follows the open method of coordination (OMC). Three CREST (Scientific and Technical Research Committee members Sweden, Romania and

Spain had volunteered to have their policies directed towards open method of coordination (OMC). The main objective of the peer review process was to help countries better understand the Policy mixes needed to raise R&D intensity by improving overall innovation system performance. The overall remit of the group is to encourage mutual learning amongst member states. Covered briefly are the highlights of Peer Review in Sweden, Spain and Romania and also the emerging generic lessons from the country reviews.

(B6) Expanding Role of Peer Review in Science Policy (USA)- This chapter explores what appears to be the increasing domain of peer review processes in science policy. The expansion of its domain in several areas is described, i.e. the allocation of federal funds, the evaluation of research programs, the evaluation of knowledge inputs to policy, the admission of expert testimony in federal courts, and in state science policy. Concluding remarks comprise of brief evaluation of these trends.

(B7) Peer Review Programs in Transparent Environment (USA)- In May 2005 American Institute of Certified Public Accountants (AICPA) Board of Directors established task force to recommend changes to the profession's peer review programs that would advance the Board's and the AICPA Council's desire for greater transparency of peer review results. Task Force recommends supplemental enhancements and revisions to peer review, as well as additional actions the AICPA should take, such as an expanded peer review communication strategy. Relevant and important topics addressed by Task Force are current peer review model and its appropriateness, Reporting Model of Peer Review, Oversight Issues, Strategy for Communication and Education, Greater Transparency, Decline in Quality Peer Review, Inconsistency in peer performance, services in scope of practice, Practice during peer review and finally Task Force recommendations/ conclusions.

(C) S&T AUDIT & PR OF AUDITORS

(1.1) Science/Technology Audit Enhances Transparency- Science Audit can promote transparency in R&D sector. Since funding is reported to be exponentially increasing in Science Departments such audit is gaining importance for the sake of transparency in funding as well as in peer review. Included herein are the objectives of the technology audit and the formation of auditing team.

(1.2) Audit of Science, Engineering and Technology Skills- As brought out in discussion paper of Departments of Education, Science and Training, Australia, Country's future prosperity relies heavily an Science, research and innovation and its ability to perform successfully in a highly competitive global market. Need is thus felt for an audit of Science, Engineering and Technology (SET) skills. Topics finding mention are the, process for such audit and SET classification for Audit.

(1.3) Peer Review of Auditors- As suggested in the caption, Securities and Exchange Board of India (Sebi) is reportedly amending the listed companies agreement to stipulate that audit firms who hold a peer review certificate will only be eligible to conduct audit of listed companies. Since process of peer review will largely depend on the quality of the reviewers, the selection process followed by ICAI for empanelment of peer reviewers is expected to be quite robust. As peer review will be only a post mortem review, it is better to adopt prevention rather than cure.

(D) PRACTICES IN INDIA

(D1) Overview of Funding Practices in India- Attempt has been made to collect the latest data and procedures followed by leading Funding Agencies in the country on the topic of peer review and its transparency such as All India Council for Technical Education (AICTE), Council of Scientific and Industrial Research (CSIR), Defence Research and Development Organization (DRDO), Department of Atomic Energy (DAE), Department of Ayurveda, Yoga,

Naturopathy, Unani, Siddha and Homeopathy (AYUSH), Department of Biotechnology (DBT), Department of Coal (DOC) Department of Ocean Development (DOD), Department of Science Technology (DST), Department of Scientific and Industrial Research (DSIR), Indian Council of Medical Research (ICMR), Indian Meteorological Department (IMD), Indian Space Research Organization (ISRO), Department of Space (DOS), Ministry of Communications & Information Technology (MOCIT), Department of Information Technology, Ministry of Environment and Forest (MOEF), Ministry of Food Processing Industries (MFPI), Ministry of New & Renewable Energy (MNRE), Ministry of Power-Central Power Research Institute (CPRI), Ministry of Social Justice & Empowerment (MOSTE), Ministry of Water Resources (MOWR), Petroleum Convention Research Association (PCRA) and University Grants Commission (UGC).

(D2) Comparative Study of Response to Questionnaire - A simple questionnaire prepared on the subject was forwarded to various central Government departments and agencies to elicit required information for further appropriate analysis. Response, though, has not been as expected, attempt is made for comparative study of responses received. Also included are the suggestions/observations emerging from Interactive Meet of experts.

(E) ALLIED SIGNIFICANT FACTORS IN PEER REVIEW

(E1) Peer Review in Fostering Regional Integration- Organization for Economic Cooperation and Development (OECD) has brought out a policy brief in May 2007 on the subject "Fostering Reginal Integration: Peer Review Southeast Asia". Though the subject is not directly related to R&D funding it will be found that some principles and observations therein can be equally relevant for transparency in peer review for R&D Funding. Peer Review has been a hallmark of OECD working methods for more than 40 years and currently covers a wide range of policy areas. The Policy Brief looks at how peer reviews can

Review followed by lessons from participating in OECD economic development reviews.

(E2) Bicameral Review of Research Proposals- It is reported that too much is expected from peer review process. First we expect it to provide ratings on the qualities of the applicants, second we expect it to provide information on whether the proposed budget are realistic and third we expect it to provide feed back to the applicants so that they can improve the research proposed. A 'reform' in the form of 'Bicameral' method of reviewing research proposals seems to be the answer. It would reform the peer review process by the separating grant applicators into two distinct parts, a retrospective part and a prospective part. Peer-review should be entirely retrospective and concerned with past performance relative to funds received. Prospective view, concerned solely with budget, should be performed in house by the funding bodies. Paper on the subject includes system's principles and practice, and what actually happens under the system. Besides alternate models like Department Model and Productivity Model, various ways are suggested here for improvements in existing system.

(F) PEER REVIEW- PRESENT AND FUTURE - In October 2006, the Czech Science Foundation (GACR), European Heads of Research Council's (EuroHORCS) an European Science Foundation (ESF) organized an international conference of Peer Review-its present and future state. The European Science Foundation was established in 1974 to create a common European platform for cross-border cooperation in all respects of scientific research. Czech Science Foundation was established in 1993 as an independent institution for support of research projects all over the World through long-term funding based on peer review evaluation and through agreements with research councils all over the world. European Heads of Research Councils is the association of the heads of public national research and research funding organizations in Europe. Established in 1992 as an informal association of national research councils and analogous public non-university research

organizations in Europe. Established in 1992 as an informal association of national research councils and analogous public non-university research organizations of the EU Member States. An attempt has been made here to describe Peer Review in Pan-European Research Funding Schemes, Peer Review in National Funding Agencies, Peer Review in scientific publishing and Assessment and selection of Research Proposals, both national and international. Also included are Transnational Research Funding Programmes and Peer Review for Evaluation of Research Institution. Also identified are the issues and the long term perspectives on the subject. Science policy context for excellent peer review suggests that a search for alternatives or mechanisms to improve it should be continued.

(G) OBSERVATIONS

(G1) This Chapter includes observations as drawn from the various materials collected on the subject.

(G2) Included here are observations/suggestions at Interactive Meet by Experts. These are found to be useful and also provide sufficient material for further thought.

(H) CONCLUSIONS

Finally some very important and pertinent points are seen in the foregoing material on the subject. These are briefly brought out under few heads such as (1.1) Identified Issues, (1.2) Science Policy Context for excellent Peer Review, and (1.3) Key questions and suggestions emanating from Interactive Meet.

A - INTRODUCTION

(A1-A5)

A1-PEER REVIEW IN GENERAL

1.1 Introduction

1. Peer review has been a touchstone of modern scientific method only since the middle of the twentieth century. Before this its application was lax.

2. Peer review is a process of subjecting an author's scholarly work or ideas to the scrutiny of others who are experts in the field. It is used primarily by editors to select and to screen submitted manuscripts, and by funding agencies, to decide the awarding of grants. The peer review process aims to make authors meet the standards of their discipline, and of science in general. Publications and awards that have not undergone peer review are likely to be regarded with suspicion by scholars and professionals in many fields.

3. A rationale for peer review is that it is rare for an individual author or research team to spot every mistake or flaw in a complicated piece of work. This is not because deficiencies represent needles in a haystack, but because in a new and perhaps eclectic intellectual product, an opportunity for improvement may stand out only to someone with special expertise or experience. For both grant-funding and publication in a scholarly journal, it is also normally a requirement that the work is both novel and substantial. Therefore showing work to others increases the probability that weaknesses will be identified, and with advice and encouragement, fixed. The anonymity and independence of reviewers is intended to foster unvarnished criticism and discourage cronyism in funding and publication decisions. US government guidelines governing peer review for federal regulatory agencies require that reviewer identity be disclosed under some circumstances. In addition, since the reviewers are normally selected from experts in the fields, the process of peer review is considered critical to establishing a reliable body of research and knowledge. Scholars reading the published articles can only be expert in a limited area; they rely to some degree on the peer-review process to provide reliable and credible research that they can build upon for subsequent or related research. As a result, significant scandal ensues when an author is found to have falsified the research included in an article, as many other scholars, and the field of study itself, may have relied upon that research.

1.2 Methodology

4. In the case of proposed publications, an editor sends advance copies of an author's work or ideas to researchers or scholars who are experts in the field (Known as "referees" or "reviewers"). Usually, there are two or three referees. These referees each return an evaluation of the work to the editor, including suggestions for improvement. Typically, most of the referees' comments are eventually seen by the author. Scientific journals observe this convention universally. The editor, usually themselves understanding the field of the manuscript (although not in as much depth as the referees who are specialists), then evaluates the referees' comments, their own opinion of the manuscript, and the context of the scope of the journal or level of the book and readership, before passing a decision back to the authors, usually with the referees' comments. Referees' evaluations usually include an explicit recommendation of what to do with the manuscript or proposal, often chosen from a menu provided by the journal or funding agency. Most recommendations are along the lines of the following:

(i) To unconditionally accept the manuscript or proposal,
(ii) To accept it in the event that its authors improve it in certain ways,
(iii) To reject it, but encourage revision and invite resubmission,
(iv) To reject it outright.

1.3 Selection of Referees

5. The task of picking reviewers typically falls to an editor. When a manuscript arrives, an editor solicits reviews from scholars or other experts who may or may not have already expressed a willingness to referee for that journal or book division. Granting agencies typically recruit a panel or committee or reviewers in advance of the arrival of applications. In some disciplines there exist refereed venues (such as conferences and workshops). To be admitted to speak, scholars and scientists must submit papers in advance. These papers are reviewed by a "program committee" (the equivalent of an editorial board), who generally requests inputs from referees. The hard deadlines set by the conferences tend to limit the options to either accept or reject the paper.

6. Typically referees are not selected from among the authors' close colleagues, students, or friends. Referees are supposed to inform the editor of any conflict of interests that might arise. Editors solicit author input in selecting referees because academic writing typically is very specialized. Editors often oversee many specialities, and may not be experts in any of them, since editors may be full time professionals with no time for scholarship. But after an editor selects referees from the pool of candidates, the editor typically is obliged not to disclose the referees' identities to the authors, and in scientific journals, to each other. Policies on such matters differ between academic disciplines.

7. Recruiting referees is a political art, because referees, and often editors, are usually not paid, and reviewing takes time away from the referee's main activities, such as his or her own research. To the would-be recruiter's advantage, most potential referees are authors themselves, or at least readers, who know that the publication system requires that experts donate their time. Referees also have the opportunity to prevent work that does not meet the standards of the field from being published, which is a position of some responsibility. Editors are at a special advantage in recruiting a scholar when they have overseen the publication of his or her work, or if the scholar is one who hopes to submit manuscripts to that editor's publication in the future. Granting agencies, similarly, tend to seek referees among their present or former grantees. Serving as a referee an even is a condition of a grant, or professional association membership. Another difficulty that peer-review organizers face is that, with respect to some manuscripts or proposals, there may be few scholars who truly qualify as experts. Such a circumstance often frustrates the goals of reviewer anonymity and the avoidance of conflicts of interest. It also increases the chances that an organizer will not be able to recruit true experts – people who have themselves done work like that under review, and who can read between the lines. Low-prestige or local journals and granting agencies that award little money are especially handicapped with regard to recruiting experts.

8. Finally, anonymity adds to the difficulty in finding reviewers in another way. In scientific circles, credentials and reputation are important, and while being a referee for a prestigious journal is considered an honor, the anonymity restrictions make it impossible to publicly state that one was a referee for a particular article. However, credentials and reputation are principally established by publications, not by refereeing; and in some fields refereeing may not be anonymous.

1.4 Ways of Review

9. Peer review can be rigorous, in terms of the skill brought to bear, without being highly stringent. An agency may be flush with money to give away, for example, or a journal may have few impressive manuscripts to choose from, so there may be little incentive for selection. Conversely, when either funds or publication space is limited, peer review may be used to select an extremely small number of proposals or manuscripts. Often the decision of what counts as "good enough" falls entirely to the editor or organizer of the review. In other cases referees will each be asked to make the calls, with only general guidance from the coordinator on what stringency to apply.

10. Very general journals such as Science and Nature have extremely stringent standards for publication, and will reject papers that report good quality scientific work, which they feel are not breakthroughs in the field. Such journals generally have a two-tier reviewing system. In the first stage, members of the editorial board verify that the paper's findings – if correct – would be ground-breaking enough to warrant publication in Science or Nature. Most papers ae rejected at this stage. Papers that do pass this 'pre-reviewing' are sent out for in-depth review to outside referees. Even after all reviewers recommend publication and all reviewer criticisms/suggestions for changes have been met, papers may still be returned to the authors for shortening to meet the journal's length limits. A similar emphasis on novelty exists in general area journals such as the Journal of the American Chemical Society (JACS). However, these journals generally send out all papers (except blatantly inappropriate ones) for peer reviewing to multiple reviewers. The reviewers are specifically queried not just on the scientific quality and correctness, but also on whether the findings are of interest to the general area readership. In the latter case the recommendation is usually for publication in a more specialized journal.

11. Screening by peers may be more or less laissez-faire depending on the discipline. Physicists, for example, tend to think that decisions about the worthiness of an article are best left to the marketplace. Yet even within such a culture peer review serves to ensure high standards in what is published. Outright errors are detected and authors receive both edits and suggestions. To preserve the integrity of the peer-review process submitting authors may not be informed of who reviews their papers; sometimes, they

might not even know the identity of the associate editor who is responsible for the paper. In many cases, alternatively called "masked" or "double-masked" review (or "blind" or "double-Blind" review), the identity of the authors is concealed from the reviewers, lest the knowledge of authorship bias their review; in such cases, however, the associate editor responsible for the paper does know who the author is Sometimes the scenario where the reviewers do know who the authors are is called "single-masked" to distinguish it from the "double-masked" process. In double-masked review, the authors are required to remove any reference that may point to them as the authors of the paper.

12. While the anonymity of reviewers is almost universally preserved, double-masked review (where authors are also anonymous to reviewers) is rarely employed. Critics of the double-masked process point out that, despite the extra editorial effort to ensure anonymity, the process often fails to do so, since certain approaches, methods, notations, etc., may point to a certain group of people in a research stream, and even to a particular person. Proponents of double-masked review argue that it performs at least as well as the traditional one and that it generates a better perception of fairness and equality in global scientific funding and publishing. Proponents of the double-masked process argue that if the reviewers of a paper are unknown to each other, the associate editor responsible for the paper can easily verify the objectivity of the reviews. Single-masked review is thus strongly dependent upon the goodwill of the participants.

13. A more rigorous standard of accountability is known as an audit. Because reviewers are not paid, they cannot be expected to put as much time and effort into a review as an audit requires. Most journals (and grant agencies like NSF) have a policy that authors much archive their data and methods in the event another researcher wishes to replicate or audit the research after publication. Unfortunately, the archiving policies are sometimes ignored by researchers.

1.5 Criticisms of Process

14. One of the most common complaints about the peer review process is that it is slow, and that it typically takes several months or even several years in some fields for a submitted paper to appear in print. In practice, much of the communication about new results in some fields such as astronomy no longer takes place through peer reviewed

papers, but rather through preprints submitted onto electronic servers. While passing the peer-review process is often considered in the scientific community to be a certification of validity, it is not without its problems. Drummond Rennie, deputy editor of Journal of the American Medical Association is an organizer of the International Congress on Peer Review and Biomedical Publication, which has been held every four years since 1986. He remarks: There seems to be no study too fragmented no hypothesis too trivial, no literature too biased or too egotistical, no design too warped, no methodology too bungled, no presentation of results too inaccurate, too obscure, and too contradictory, no analysis too self-serving, no argument too circular, no conclusions too trifling or too unjustified, and no grammar and syntax too offensive for a paper to end up in print.

15. There are also allegations of bias and suppression some sociologists of science argue that peer review makes the ability to publish susceptible to control by elites and to personal jealousy. The peer review process may suppress dissent against "mainstream" theories. Reviewers tend to be especially critical of conclusions that contradict their own views, and lenient towards those that accord with them. At the same time, elite scientists are more likely than less established ones to be sought out as referees, particularly by high prestige journals or publishers. As a result, it has been argued, ideas that harmonize with the elite's are more likely to see print and to appear in premier journals than are iconoclastic or revolutionary ones, which accords with Thomas Kuhn's well-known observations regarding scientific revolutions. Others have pointed out that there is a very large number of scientific journals in which one can publish, making total control of information difficult. In addition, the decision-making process of peer review, in which each referee gives their opinion separately and without consultation with the other referees, is intended to mitigate some of these problems. Nonetheless, which it is generally possible to publish results somewhere, in order for scientists in many fields to attract and maintain funding it is necessary to publish in elite, prestigious journals. Such journals are generally identified by their impact factor. The small number of high impact journals is susceptible to control by an elite group of anonymous reviewers. Results published in low-impact journals are usually ignored by most scientists in any field. This has led to calls for the removal of reviewer anonymity (especially at high-impact journals) and for the introduction of author anonymity (so that reviewers cannot tell whether the author is a member of any elite)

1.6 System Failures

16. Peer review failures occur when a peer-reviewed article contains obvious fundamental errors that undermines at least one of its main conclusions. Peer review is not considered a failure in case of deliberate fraud by authors. Letters-to-the-editor that correct major errors in articles are a common indication of peer review failures. Many journals have no procedure to deal with peer review failures beyond publishing letters. Some do not even publish letters. The author of a disputed article is allowed a published reply to a critical letter. Neither the letter nor the reply is usually peer-reviewed, and typically the author rebuts the corrections. Thus, the readers are left to decide for themselves if there was a peer review failure. An alternative method of dealing with peer review failures is correction via another peer-reviewed article. For example, a claim that the plant hormone, ethylene, increased plant membrane permeability was shown to be an artifact caused by the low pH of the ethylene-releasing chemical, (2-chloroethyl)-phosphonic acid, employed. One disadvantage of this approach is that a reader who spots major flaws in an article may not have the time or resources to do the research and writing required for a peer-reviewed rebuttal article.

17. A famous peer review failure was the 1977 Science article on the "dodo and seed germination" that lacked the required control treatment for its main experiment among other major flaws. Another glaring peer review failure involved a 1993 Bioscience article on Jean Baptist van Helmont. It had several major factual errors and no references for those supposed facts. Bioscience refused to publish a letter pointing out the factual errors and would not consider publishing a peer-reviewed article correcting the original article. Acknowledged deviations from the idealized outcome of the peer review process are readily observable at both extremes: successful without peer review prior to publication on the one hand; and unsuccessful despite peer review on the other extreme. Among the widely known examples of work later acknowledged to be successful without peer review prior to publication is that of Watson and Crick's 1953 paper on the structure of DNA published in Nature. It also served as a rebuttal to a peer review failure. A widely known example of the other extreme is the Jacques Benefits affair, where reviews peer was exercised prior to publication in the journal Nature and the published results were unable to be replicated by other researchers.

1.7 Peer Review and Fraud

18. Peer review, in scientific journals, assumes that the article reviewed has been honestly written, and the process is not designed to detect fraud. The reviewers usually do not have full access to the data from which the paper has been written and some elements have to be taken on trust. It is not usually practical for the reviewer to reproduce the author's work unless the paper deals with purely theoretical problems, which the reviewer can follow in a step-by-step manner. The number and proportion of articles which are detected as fraudulent at review stage is unknown. Some instances of outright scientific fraud and scientific misconduct have gone through review and were detected only after other groups tried and failed to replicate the published results. An example is the case of "Jan Hendrik Schon", in which a total of fifteen papers were accepted for publication in the top ranked journals Nature and Science following the usual peer review process. All fifteen were found to be fraudulent and were subsequently withdrawn. The fraud was eventually detected, not by peer review, but after publication when other groups tried and failed to reproduce the results of the paper.

19. The International Committee for Medical Journal Editors' Uniform Requirements for Manuscripts submitted to Biomedical Journals states that "if a fraudulent paper has been published, the journal must print a retraction", and gives guidelines on investigating alleged fraud. Members of the UK-based Committee on Publication Ethics (COPE) have a duty to investigate allegations of misconduct. Although it is often argued that fraud cannot be detected during peer review, the Journal of Cell Biology uses an image screening process that it claims could have identified the apparently manipulated figures published in Science by Woo-Suk Hwang. A brief, up-to-date report on this Korean Scientist is enclosed as Annexure I

(i) *Plagiarism*

20. A poll of around thousand scientists funded by the U.S. National Institutes of Health found 0.3% admitted faking data, 1.4% admitted plagiarism, and 4.7% admitted to autoplagiarism. Autoplagiarism involves an author republishing the same material or data without citing their earlier work. An author often uses autoplagiarism to pad their list of publications. Sometimes reviewers detect cases of likely plagiarism and bring them to

the attention of the editor. Reviewers generally lack access to raw data, but do see the full text of the manuscript. Thus, they are in a better position to detect plagiarism or autoplagiarism of prose than fraudulent data. Although it is more common than plagiarism, journals and employers often do not punish authors for autoplagiarism. Autoplagiarism is against the rules of most peer-reviewed journals, which usually require that only unpublished material be submitted.

(ii) *Professional Misconduct*

21. A related form of professional misconduct that is a reviewer using the not-yet-published information from a manuscript or grant application for personal or professional gain. The frequency with which this happens is of course unknown, but the United states Office of Research Integrity has sanctioned reviewers who have been caught exploiting knowledge they gained as reviewers.

1.8 Dynamic / Open Peer Review

22. It has been suggested that traditional anonymous peer review lacks accountability, can lead to abuse by reviewers, and may be biased and inconsistent, alongside other flaws. In response to these criticisms, other systems of peer review have been suggested. In 1996, the Journal of Interactive Media in Education launched using open peer review. Reviewers' names are made public and they are therefore accountable for their review, but they also have their contribution acknowledged. Authors have the right of reply, and other researchers have the chance to comment prior to publication. In 1999, the British Medical Journal moved to an open peer review system, revealing reviewers' identities to the authors, and in 2000, the medical journals in the open access, published by Bio Med Central, launched using open peer review. As with the BMJ, the reviewers' names are included on the peer review reports. In addition, if the article is published the reports are made available online as part of the 'pre-publication history' Several of the other journal published by the BMJ group allow optional open peer review as do PloS Medicine, published by the Public Library of Science and the Journal of Medical Internet Research. The evidence of the effect of open peer review upon the quality of reviews, the tone and the time spent on reviewing is mixed, although it does seem that under open peer review, more of those who are invited to review decline to do so.

23. In June 2006, the high impact journal Nature launched an experiment in parallel open peer review – some articles that had been submitted to the regular anonymous process were also available online for open, identified public comment. The results were less than encouraging – only 5% of authors agreed to participate in the experiment, and only 54% of those articles received comments. The editors have suggested that researchers may have been too busy to take part and were reluctant to make their names public. The knowledge that articles were simultaneously being subjected to anonymous peer review may also have affected the uptake. Also a group of UK academics launched the online journal Philica, which tries to redress many of the problems of traditional peer review. Unlike in a normal journal, all articles submitted to Philica are published immediately and the review process takes place afterwards. Reviews are still anonymous, but instead of reviewers being chosen by an editor, any researcher who wishes to review an article can do so. Reviews are displayed at the end of each article, and so are used to give the reader criticism or guidance about the work, rather than to decide whether it is published or not. This means that reviewers cannot suppress ideas if they disagree with them. Readers use reviews to guide what they read, and particularly popular or unpopular work is easy to identify.

24. Another approach that is similar in spirit to Philica is that of a dynamical peer review site, Naboj. Unlike Philica, Naboj is not a full-fledged online journal, but rather it provides an opportunity for users to write peer reviews of preprints at arrive. Org. The review system is modeled on Amazon and users have an opportunity to evaluate the reviews as well the articles. That way, with a sufficient number of users and reviewers, there should be a convergence towards a higher quality review process. In February 2006, the journal Biology Direct was launched by Eugene Koonin, Laura, Land Weber, and David Lipman, providing another alternative to the traditional model of peer review. As with Philica, reviewers cannot suppress publication, but in contrast to Philica, no reviews are anonymous and no article is published without being reviewed. Authors have the opportunity to withdraw their article, to revise it in response to the reviews, or to publish it without revision. If the authors proceed with publication of their article despite critical comments, readers can clearly see any negative comments along with the names of the reviewers. An extension of peer review beyond the date of publication is Open Peer Commentary, whereby expert commentaries are solicited on published articles, and

the authors are encouraged to respond. The BMJ's Rapid Responses allow ongoing debate and criticism following publication. By 2005, the editors found it necessary to more rigorously enforce the criteria for acceptance of Rapid Responses, to weed out the bores.

25. The technique of peer review is also used to improve government policy. In particular, the European union uses it as a tool in the 'Open Method of Coordination' of policies in the field of employmental social inclusion.

(A2)-PEER REVIEW – A TOOL FOR COOPERATION AND CHANGE

26. Above study conducted sometime back examines the practice of peer review and the related effect of peer pressure in the context of international organizations particularly the OECD. It outlines the main features of these two concepts and attempts to establish a model based on the different peer review mechanisms used at OECD.

2.1 The Concept

27. Peer review can be described as the systematic examination and assessment of the performance of a State by other States, with the ultimate goal of helping the reviewed State improve its policy making, adopt best practices, and comply with established standards and principles. The examination is conducted on a non-adversarial basis, and it relies heavily on mutual trust among the States involved in the review, as well as their shared confidence in the process. When peer review is undertaken in the framework of an international organisation – as is usually the case – the Secretariat of the organisation also plays an important role in supporting and stimulating the process. With these elements in place, peer review tends to create, through this reciprocal evaluation process, a system of mutual accountability. An individual country peer review could relate to economics, governance, education, health, environment, energy or other policies and practices. Within one or more of those subject areas, a State may be examined against a wide range of standards and criteria, such as conformity with policy guidelines, or implementation of legally binding principles. Peer review can also be carried out thematically, where several countries are examined at the same time with respect to a particular theme. Peer review with regard to an individual State or thematically typically is carried out on a regular basis, with each review exercise resulting in a report that assesses accomplishments, spell out shortfalls and makes recommendations.

2.2 Peer Pressure

28. The effectiveness of peer review relies on the influence and persuasion exercised by the peers during the process. This effect is known as "peer pressure". The peer review process can give rise to peer pressure through, for example: (i) a mix of formal

recommendations and informal dialogue by the peer countries; (ii) public scrutiny, comparisons, and, in some cases, even ranking among countries; and (iii) the impact of all the above on domestic public opinion, national administrations and policy makers. The impact will be greatest when the outcome of the peer review is made available to the public, as is usually the case at the OECD. When the press is actively engaged with the story, peer pressure is most effective. Public scrutiny often arises from media involvement. Peer pressure is particularly effective when it is possible to provide both qualitative and quantitative assessments of performance. The quantitative assessment might take the form of a ranking of countries according to their performance, and the drawing of real scoreboards reflecting such rankings. An example is the OECD Jobs Strategy, a Programme which sets out principles and benchmarks, carries out quantitative analysis and ranks country according to their performances in reducing unemployment. Another example, outside the OECD, of a very effective scoreboard is the Internal Market Scoreboard, maintained by the European Commission, which ranks the EU Members States according to their performance in the completion of the internal market. A variation of this system is the "naming and shaming" technique, which singles out poor performers. However, these methods are appropriate and produce positive results only when the "rules of the game" are clear and the countries accept them. In other cases, this type of approach could risk shifting the exercise from an open debate to a diplomatic quarrel to gain position on the scoreboard.

2.3 Practice in International Organisations

29. While peer review as a working method is most closely associated with the OECD, several other intergovernmental organisations and international programmes make use of this technique as well. Within UN bodies and specialised agencies, States use peer review to monitor and assess national policies in various sectors, from environment to investment. The IMF Country Surveillance mechanism also has some aspects in common with peer review. Peer review has also been developed within the World Trade Organisation under the Trade Policy Review Mechanism. The WTO system monitors trade policy and practice in the Member States. A designated WTO body then meets to review the policy statements presented by the Member under review and a report prepared by the Secretariat. This examination is led by two reviewing countries. The procedure concludes with the Final Remarks of the Chair, which are published together

with the policy statement of the country under review, the report of the Secretariat and the minutes of the meeting. In the European Union framework, peer review is used in several areas. For example, the DG Employment and Social Affairs of the European Commission has developed peer review for national labour market policies to identify good practices and assess their transferability and hence transparency.

2.4 Practice in OECD

30. There is no other international organisation in which the practice of peer review has been so extensively developed as the OECD, where it has been facilitated by the homogeneous membership and the high degree of trust shared among the Member countries. The OECD has used this method since its creation and peer review has, over the years, characterised the work of the Organisation in most of its policy areas. Within the Organisation, peer review is carried out in several substantive areas and there is no standardised peer review mechanism. However, all peer reviews contain the following structural elements.

(i) A basis for proceeding;

(ii) An agreed set of principles, standards and criteria against which the country performance is to be reviewed;

(iii) Designated actors to carry out the peer review; and

(iv) A set of procedures leading to the final result of the peer review.

2.5 Functions of Peer Review

31. Peer review can be used in a broad range of areas, including those not covered by OECD peer review exercises – for example, human rights and democratic governance. In each of these fields, peer review, directly or indirectly, can serve the following purposes:

(i) Policy dialogue

32. During the peer review process, countries systematically exchange information, attitudes and views on policy decisions and their application. This dialogue can be the basis for further co-operation, through, for example, the adoption of new policy guidelines, recommendations or even the negotiation of legal undertakings;

(ii) Transparency

33. The reviewed country has the chance, in the course of a peer review, to present and clarify national rules, practices and procedures and explain their rationale. As a result, the Secretariat is usually able to develop documentation and, in certain cases, a database which remains at the disposal of the Member countries, and which often is also made available to the public and published on the Organisation web site.

(iii) Capacity building

34. Peer review is a mutual learning process in which best practices are exchanged. The process can therefore serve as an important capacity building instrument – not only for the country under review, but also for countries participating in the process as examiners, or simply as members of the responsible collective body. For example, certain methodologies commonly used in peer review – such as benchmarking or recourse to quantitative indicators in assessing compliance with policies – are unfamiliar to some officials and even to some public administrations before they participate in the peer review, and the exercise therefore represents an important learning opportunity;

(iv) Compliance

35. An important function of peer review is to monitor and enhance compliance by countries with internationally agreed policies, standards, and principles. However, unlike a traditional legal enforcement mechanism, peer review works as a sort of "soft enforcement" system, resulting in non-coercive final reports and recommendations rather than binding coercive acts, such as sanctions. In many contexts, the soft law nature of peer review can prove better suited to encouraging and enhancing compliance than a traditional enforcement mechanism.

2.6 Conclusion

36. The effectiveness of peer review depends upon the combination of a number of factors, which may be summarized as follows:

(i) Value sharing

37. One precondition for an effective peer review is convergence among the participating countries on the standards or criteria against which to evaluate performance. A strong common understanding on these will prevent uncertainty or backtracking during the process;

(ii) Adequate level of commitment

38. Peer review can function properly only if there is an adequate level of commitment by the participating countries in terms of both human and financial resources. Thus, the participating countries must not only place adequate financial means at the disposal of the Secretariat; they must also be fully engaged in the process at different times as examiners, as active members of the collective body, and as subject of the examination;

(iii) Mutual trust

39. Since peer review is, by its nature, a co-operative, non-adversarial process, mutual trust is an important basis for its success. While the peer review process itself can contribute to confidence building, a large degree of trust and value sharing among the participants should be present from the beginning to facilitate, among other things, the disclosure of data, information and documentation which are essential to the process;

(iv) Credibility

40. The credibility of the peer review process is essential to its effectiveness, and to its added value in comparison with governmental reports or consultants' certifications. There is a strong linkage between the credibility of the process and its capacity of influence. To assure this credibility, the approach that the examiners – with the help of the Secretariat – take in the review must be objective, fair and consistent. In the same way, the Secretariat must guarantee independence, transparency and quality of work. Credibility can be undermined if the process is flawed by such factors as unqualified examiners, bias stemming from national interests, or inadequate standards or criteria against which to undertake the review. However, the main threat to the credibility of the process is the possibility of attempts by the reviewed State to unduly influence the final

outcome. The involvement of the reviewed State in the process and its ownership of the outcome of the peer review is the best guarantee that it will ultimately endorse the final report and implement its recommendations. However the State's involvement should not go so far as to endanger the fairness and the objectivity of the review. For example, the State under review should not be permitted to veto the adoption of all or part of the final report.

41. With each of these factors in place, peer review can serve as a stimulus to incremental change and improvement. Through the accompanying effect of peer pressure – including both persuasion by other countries and the stimulus of domestic public opinion – peer review can create a catalyst for performance enhancement which can be far-reaching and open-ended.

A3-SCIENTIFIC PEER REVIEW

3.1 Background

42. For much of the last century, peer review has been the principal mechanism by which the quality of research is judged. In general, the most respected research findings are those that are known to have been reviewed by a researcher's peers. Most funding decisions in science are based on peer review. Academic advancement is generally based on success in achieving peer-reviewed publication and funding, and typically include peer review of the candidate's academic career. Clearly, research depends greatly on peer review.

43. Peer review is based on the concept that, because much of academic inquiry is relatively specialized, peers with similar expertise are in the best position to judge one another's work. This mechanism is largely designed to evaluate the relative quality of research. However, with appropriate feedback, it can also be valuable tool to improve a manuscript, a grant application, or the focus of an academic career. Despite these advantages, the process of peer review is hampered by both perceived and real limitations.

Criticism of Peer Review

44. Peer review has been criticized because of several problems, including the fears that reviewers may:

(i) Take advantage of ideas in manuscripts that are not yet published and grant proposals that are not yet funded.

(ii) Be biased in favour of well-known researchers or institutions.

(iii) Review the work of a competitor unfairly

(iv) Be insufficiently qualified to provide an authoritative review

45. Many attempts have been made to examine these assumptions about the peer review process, and most have found such problems to be, at worst, infrequent. Nonetheless problems do occur. For example, reviewers may be less likely to criticize work that is consistent with their own perceptions or to award a fellowship to a woman rather than a man. Not surprisingly, because the process of peer review is highly subjective, it is possible that some people will abuse the process or act based on intentional or unintentional biases. In addition to concerns about bias, peer review of publications does not do well at detecting innovative research or filtering out fraudulent, plagiarized, or redundant publications. Although laudable, these goals are not the strengths of peer review. However, this does not mean that peer review has no value. As Godlee concludes: that there is evidence that it contributes to maintaining standards in published science, both by ensuring that lower-quality research does not appear in the higher-impact journals and by improving the quality of accepted articles before publication.

3.2 Principles

46. Considering the possible failings of peer review, and the potential for bias and abuse of the process, the following principles for conduct might help to minimize problems while maintaining the advantages.

(i) Effectiveness

An effective process for peer review is essential to promote academic integrity.

(ii) Competence

Reviewers should have the expertise to provide an authoritative review.

(iii) Usefulness

Candidates should expect that procedures for review will be followed in a timely fashion and the reviewers' comments will be constructive.

(iv) Security

Candidates should be confident that the peer review process minimizes the risks of bias and that reviewers will not take unfair advantage of privileged information

3.3 Rules

47. Peer review is governed by federal regulations in three respects. First, federal misconduct regulations can be invoked if a reviewer seriously abuses the review process. Under Public Health Service (PHS) existing regulations (PHS, 2000), this is covered by the prohibition against"... practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting, or reporting research." Under proposed government-wide regulations (Office of Science and Technology Policy, 2000) the review process is explicitly noted in the new definition of research misconduct (emphasis added): Fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results."

48. Second, peer review for the grant review process is governed in part by federal regulations. The focus on Title 42 Part 52h of the Code of Federal Regulations is the peer review of PHS grant and contract applications (PHS, 200a). These regulations prohibit review by individuals with conflicts of interest:

49 "No member of a peer review group may participate in or be present during any review by said group of a grant application, contract project, or contract proposal in which, to the member's knowledge, any of the following has a financial interest; (i) The member or his her spouse, parent, child, or partner, (ii) any organization in which the member or his or her spouse, parent, child, or partner is serving as an officer, director, trustee, partner, or employee, or is otherwise similarly associated, or (iii) any organization with which the member or his or her spouse, parent, child, or partner is negotiating or has any arrangement concerning prospective employment or other similar association."

50. Third, federal regulation in this area includes the proposed requirement that discussion of peer review should be part of instruction in the responsible conduct of research (i.e., Office Research Integrity, 2000).

3.4 Guidelines

51. Although much of peer review is not directly governed by federal regulations, reviewers have several places to look for guidance. Most organizations reviewing research have specific guidelines regarding confidentiality and conflicts of interest. In addition, many organizations and institutions have guidelines dealing explicitly with the responsibilities of peer reviewers, such as those of the American Chemical Society (1996), the Society for Neuroscience (1999), and the Council of Biology Editors (CBE Peer Review Retreat Consensus Group, 1995). Some of these documents and the principles discussed above are a basis for guidelines that should be followed by peer reviewers:

(i) Responsive

52. Reviewers are responsible for following the instructions for completing a review and doing so in a timely fashion. Failing to do so undermines the review process. Every effort should be made to complete the review in the time requested. Research reports, grant applications, and academic files submitted for review all represent a significant investment of time and effort. A delay in reviewing such material should occur only because of extraordinary circumstances. If it is not possible to meet the conditions for the review, the reviewer should promptly decline to perform the review or should see if some accommodation can be made to resolve the problem.

(ii) Competent

53. Reviewers who realize that their expertise is limited have a responsibility to make their degree of competence clear to the editor, funding agency, or academic institution asking their opinion. In addition, reviews should take into account the ethical dimensions of the work (e.g., in studies with human or animal subjects).

Although a reviewer may not be an expert in every aspect of the review, the assignment should be accepted only if he or she has adequate expertise to provide an authoritative assessment. A reviewer who does not have the requisite expertise is at risk of accepting a submission that has substantial deficiencies or rejecting one that is meritorious. Such errors are a waste of resources. In such cases, a reviewer should decline the review.

(iii) Unbiased

54. Reviewers' comments and conclusions should be based on an objective consideration of the facts, exclusive of personal or professional bias. To the extent possible, the system of review should be designed to minimize actual or perceived bias on the reviewer's part. If reviewer has any interest that might interfere within objective review, then he or she should either decline a role as reviewer or declare the conflict of interest to the editor, funding agency, or academic institution and ask how best to manage the conflict of interest.

(iv) Confidential

55. Material under review should not be shared or discussed with anyone outside the designated review process unless necessary and approved by the editor, funding agency or academic institution. Material submitted for peer review is a privileged communication that should be treated in confidence. While it is expected that the editor, funding agency administrators, institutional officials, and/pr reviewers will have access to the material submitted, authors, grant applicants, and candidates for academic review have a reasonable expectation that the review process will remain confidential. If a reviewer is not sure about policies for enlisting the help of others in the review process, then he or she should ask.

(v) Secure

56. A reviewer should not take scientific, financial, personal, or other advantage of material available through the privileged communication of peer review. One exception is that if the reviewer becomes aware that a line of his or her own research is likely to be unprofitable, a waste of resources, then it is considered ethical to discontinue that work (American chemical Society, 1996; Society for Neuroscience, 1999). In such cases, this decision should be communicated to the individual(s) requesting the review. Otherwise, every effort should be made to avoid even the appearance of taking advantage of information obtained through the review process. Potential reviewers concerned that their participation would represent a substantial conflict of interest should decline the request to review.

(vi) Constructive

57. Reviewers' comments should acknowledge positive aspects of the material under review, assess negative aspects constructively, and indicate clearly the improvements needed. Anything less leaves the candidate with no insight into the deficiencies in the submitted work. The purpose of peer review is not to demonstrate the reviewer's proficiency in identifying flaws. Reviewers have the responsibility to identify strengths and provide constrictive comments to help the author or candidate to resolve weaknesses in his or her wok. A reviewer should be an advocate for the candidate.

(vii) Responsible

58. Peer review depends, by definition, on the willingness of peers to participate as reviewers usually without financial compensation. Therefore, the privilege of working in research may include the responsibility to share in the task of reviewing the work of peers. In addition to being an ethical responsibility, it should be noted that experience as a reviewer also has practical advantages. These include the opportunity to better understand the peer review system to become more aware of the work of peers, and to develop lines of communication with other peer reviewers.

A4-THE ARBITER OF SCIENTIFIC QUALITY- MANUSCRIPT PEER REVIEW

59. Developments in science and medicine are frequently the subject of news headlines and public discussion. More scientific information is being put into the public domain and a growing number of organizations are becoming involved in promoting and discussing scientific research and reacting to new research claims. With so much information it is often difficult to judge which research claims should be taken seriously? Which are 'scares'? Sometimes scientists are reported as saying conflicting things. How do we know what to believe?

60. There is a system used by scientists to decide which research should be published in a scientific journal. This system, called peer review, subjects scientific research papers to independent scrutiny by other qualified scientific experts (peers) before they are made public. Over one million papers about scientific research are published in scientific journals worldwide annually. Despite its extensive use and recognition among scientists in assessing the plausibility of research claims, in the rest of society very little is known about the existence of the peer-review process or what it involves sense about science believes that peer review is an essential arbiter of scientific quality and that information about the status of research results is as important as the findings themselves.

4.1 Sense about Science

61. Sense About Science – a charity devoted to the promotion of evidence-based approaches to scientific issues – has produced a timely guide to the peer review process. It explains with welcome clarity just what goes on behind the scenes before a research paper is published in a respectable journal and why the procedures are so important. For the reader of media science stories it is an invaluable tool for detecting the hallmarks of sound research and the warning signs that might make us wary of taking the report too seriously. Journalists would also do well to note the guide's content.

4.2 General

62. Every day we are bombarded with information about science from newspapers, radio and television programmes and the internet. Making sense of it all can be very difficult. What should be taken seriously? Which are 'scares'? Sometimes scientists are reported as saying conflicting things. How do we know what to believe? There is a

system used by scientists to decide which research results should be published in a scientific journal. This system, called **peer review**, subjects scientific research papers to independent scrutiny by other qualified scientific experts (peers) before they are made public.

63. Peer review can help you make sense of science stories as it tells you that the research has passed the scrutiny of other scientists and is considered **valid, significant and original.** Peer review means that statements made by scientists in scientific journals are critically different from other kinds of statements or claims, such as those made by politicians, newspaper columnists or campaign groups. Science is therefore more than just another opinion.

4.3 Peer Review – as explained

64. When a researcher, or team of researchers, finishes a stage of work, they usually write a paper presenting their methods, findings and conclusions. They then send the paper to a scientific journal to be considered for publication. If the journal's editor thinks it is suitable for their journal they send the paper to other scientists who research and publish in the same field asking them to:

- Comment on its validity – are the research results credible; are the design and methodology appropriate?
- Judge the significance – is it an important finding?
- Determine its originality – are the results new? Does the paper refer properly to work done by others?
- Give an opinion as to whether the paper should be published, improved or rejected (usually to be submitted elsewhere).

65. This process is called peer review. The scientists (peers) assessing the papers as called referees or reviewers.

66. Peer review is also used to assess scientists' applications for research funds. Funding bodies such as medical research charities, seek expert advice on a scientists' proposal before agreeing to pay for it. Peer review in this instance is used to judge which applications are the best science and have the potential to help the organization achieve its objectives.

4.4 Science Publishing Scene

67. As per figures of year 2005, there are around 21,000 scholarly and scientific journals that use the peer review system. A high proportion of these are scientific, technical or medical journals, publishing over million research papers each year.

68. For scientific knowledge to progress scientists need to share their research findings with other scientists. The main way they do this is by publishing their research in scientific journals – periodical publications intended to further the development of science by reporting new research. Journal editors receive many more papers than they can publish, so they use a two-step selection process. First, they consider whether the paper is a 'fit' for their journals. For example, some journals only publish research papers that are groundbreaking; others only publish research in a specific area, such as microbiology.

69. If a journal editor decides that a paper is right for their journal, they send it for peer review to check whether the research findings are valid, significant and original.

70. Publishing in a journal is an integral part of being a scientist, It:

- Connects like-minded individuals and tells them about new research. A published paper is read by scientists all around the world.
- It is a permanent record of what has been discovered, when and by which scientists – like a court register for science.
- Helps scientists to promote their work and gain recognition from fenders and other institutions.
- Shows the quality of the scientist's work: other experts have rated it as valid, significant and original.

71. When research findings have been reviewed and published in a scientific journal, this indicates that they are sufficiently valid, significant and original to merit the attention of other scientists. Peer review is an essential dividing line for judging what is scientific and what is speculation and opinion. Most scientists make a careful distinction between their peer-reviewed findings and their more general opinions.

72. Publication of a peer-review paper is just the first step: findings, and theories about them, must go on to be re-tested and judged against other work in the

same area. Some papers' conclusions will be disputed or further research will show that they need to be revised as more data are gathered.

4.5 Challenges for Peer Review

73. Assessing scientific papers cannot be done in the same way as marking a maths test. New research usually has its own unique features, which are difficult to predict with a check list and which require expert judgement about their validity, significance and originality.

74. Peer review is not a fraud detection system. Referees are likely to detect some wrongdoing, such as copying someone else's research or misrepresenting data, because they care about their subject. They know what research has been conducted already and the kinds of results that are likely. However, if someone deliberately sets out to falsify data, there is sometimes no way of knowing this until the paper is published and others in the scientific community scrutinize and try to repeat the work.

75. Sometimes people worry that new ideas won't be understood by other scientists (although this is also an excuse given when researchers don't want to submit to the scrutiny of their peers). It is true that referees can be cautious about unusual findings; and important insights can initially be overlooked. But if someone has been exceptionally clever, other scientists are most likely to recognize it and to distinguish it from flawed or inflated claims. Journal editors like novel ideas and scientific publishing has brought thousands of important discoveries to light.

76. In our world of instant communication and 24-hour news, a deliberative process like peer review can seem frustratingly slow. Electronic communication has improved it, but good assessment of research does take time. Some times people justify the promotion of unpublished findings by saying they are 'too important to wait'. But, although some papers take months to review and improve, if there is a major breakthrough the process can be completed in weeks. Furthermore, if the findings are very important – e.g. they concern public health – then it is all the more necessary to check them through peer review.

4.6 Summary

(i) Science has a system for assessing the quality of research before it is published. This system is called **peer review.**

(ii) Peer review means that other scientific experts in the field check research papers for validity**, significance and originality** – and for clarity.

(iii) Editors of scientific journals draw on a large pool of suitable experts to scrutinize papers before deciding whether to publish them.

(iv) Many of the research claims you read in newspapers and magazines, find on the internet, or hear on television and the radio are not published in a peer-reviewed journal.

(v) Some of this research may turn out to be good but much of it is flawed or incomplete. Many reported findings, such as claims about "wonder cures" and "new dangers", never come to anything.

(vi) Unpublished research is no help to anyone. Scientists can't repeat or use it and as a society we can't base decision, about our public safety – or our family's health for example on work that has high chance of being flawed.

(vii) So, no matter how exciting or compelling new scientific or medical research is, you must always ask... **Is it peer reviewed? If not, why not?** If it is peer reviewed, you can look for more information on what other scientists say about it, the size and approach of the study and whether it is part of abode of evidence pointing towards the same conclusions.

77. Many of us find professional peer review very useful: it suggests different perspectives and provides valuable feedback on what is compelling at what is problematic in a manuscript. It should come as no surprise then, that students also find peer review valuable. The benefits of peer review sessions include the following:

(i) Students must begin the writing process early, and get feedback before they turn in their paper to instructor, (ii) Students recognize the strengths and weaknesses of their own writing after reading and responding to another paper, (iii) Students develop a greater sense of and sensitivity to audience, (iv) Students learn new information from their peers' papers.

78. A particularly effective way to guide students is by developing and using feedback forms. This can be done by converting list of characteristics into a peer feedback form. List of open-ended questions what can be developed one as per samples given next:

Sample 1: OPEN-ENDED FORM (leave space for review comments)

Author _____

Reviewer _____

The goals of the peer review are 1) to help improve your classmate's paper by pointing out strengths and weaknesses that may not be apparent to the author, and 2) to help improve editing skills.

INSTRUMENTS: Read the paper assignment to yourself twice, once to get an overview of the paper, and a second time to provide constructive criticism for the author to use when revising paper.

Answer the questions below:

ORGANIZATION

1. Are the basic sections (intro, conclusion, etc.) adequate? If not, what is missing?
2. Is the thesis in the first paragraph? Does it make an argument?
3. Does each paragraph address one issue, and relate back to the main thesis? Explain.
4. Was the material ordered in a way that was logical, clear, and easy to follow?

CITATIONS

1. Does the writer cite sources adequately and appropriately? Note any incorrect formatting.
2. Are there enough references to other sources?

GRAMMAR AND STYLE

1. Are there any grammatical or spelling problems?
2. Is the writer's writing style clear?

Sample 2: CRITERIA GRID

	Satisfactory	Strong	CRITERIA	READER'S COMMENTS
			Thesis: Clear, comprehensive, answers assignment question.	
			Evidence/Support for thesis: relevance, strength, credibility.	
			Organization: arrangement of ideas, coherence, inclusion of intro and conclusion.	
			Mechanics: spelling, grammar, punctuation.	
			Overall effectiveness.	

(A5)-PEER REVIEW SYSTEMS FOR GOVERNMENT SPONSORED RESEARCH

79. Seeking advice from experts before making an important decision is common sense. Large scale peer review on the basis of government funding of scientific research took place after the Second World War. At the time, a common belief was that science made progress by a smooth incremental or cumulative process. Influential people like George Sarton (The History of Science and the New Humanism, Cambridge University Press, 1937), James B. Conant, and Lord Ernest Rutherford all believed and promoted such a view. That being the case, it seemed reasonable to expect that the advise from a panel of experts or peers is the most reliable way of correctly determining the merit of a piece of proposed research. This once popular view of cumulative growth of science was later shown to be only partially correct and largely mistaken. Major upheavals or revolutions often took place in between periods of incremental and cumulative developments. Unfortunately, by the time the mistake was broadly recognized and a correct view adopted through the writings of Herbert Butterfield (The Origin of Modern Science 1300-1800, G. Bell and Sons, London, 1949), Rupert Hall (The Scientific Revolution 1500-1800, Longmans, Green and Co,. London, 1954) and Thomas Kuhn (The structure of Scientific Revolution, Univ. Chicago Press, Chicago, 1962), the peer review system was an established tradition in US government institutions and elsewhere. Worse, in more than one confused mind, peer review has replaced objective evidence as proof of truth.

80. The peer review systems adopted for government-sponsored research funding can be roughly sorted out into two types. One type was first adopted by the Office of Naval Research (ONR) and the National Science Foundation (NSF); the other type was that introduced by the National Institutes of Health (NIH).

5.1 ONR-NSF System

81. This system places greater responsibility on the individual program managers. A researcher seeking support writes a proposal describing what he/ she plans to do and submits it along with the endorsement from the Institution where he/she is employed.

The specific program manager covering that field reads the proposal and sends it out to different experts in the field and seeks their opinions. Based on the opinions gathered, the program manager makes the final decision to fund the proposal or to reject it. The good side of this system is that it has flexibility. When the program manager is dedicated and has the needed knowledge, courage and integrity, the system can work well. The down side of the ONR-NSF system is that if the program manager does not have enough knowledge and self confidence, and/or cares little about the true objective of scientific research, he/she can do a great deal of damage to Science.

82. Thus in the words of Representative John B. Conlan from Arizona: the system can turn into an 'Old Boy's System' where program managers rely on trusted friends in the academic community to review their proposals. These friends recommend their friends as reviewers...It is an incestuous buddy system that frequently stifles new ideas and scientific breakthroughs, while carving up the multimillion dollar. Federal research and education pie in a monopoly game of draftsmanship.

5.2 NIH System

83. NIH is a much larger conglomerate of semi-independent Institutions (e.g., National Cancer Institute, National Heart Institute). Each has its own research laboratories and researchers, constituting what is called "intramural activities". It is the "extramural activity" that oversees funding of research conducted by researchers outside NIH, often in the Universities. This funding is handled by a single NIH institution called the Division of Research Grants. Although there is a second level of peer review by a national advisory council made up by scientists and laymen, the major decision on the funding of research proposal is made by scientists sitting on the Initial Review Groups (IRG) also called Study Sessions.

84. Research Proposals, written by research grant applicants are distributed by the Division of Research Grants to one of the Study Sessions for review. Of those proposals recommended for approval, each of the Study Sections members gives (anonymously) a priority score ranging from 100 (highest) to 500 (lowest) and the average determines funding or non – funding. Sometimes a difference of a few points determines "life" or death" of the proposal. Even though each Study Section member (which usually number

between 10 and 20 but may be more) gives a numerical score, only two of the members read any one proposal. For this reason, there is no chance for a proposal to be funded, unless those two readers absolutely wish the proposal to be funded; they are the proposal's only advocates. None of the other member really has the detailed knowledge of the proposal to challenge the opinions of the readers, not to mention that they must all cooperate with one another so that proposals read by other members of the Study Section can be accepted or rejected as recommended by their readers.

85. The power wielded by the two "readers" can be seen from an NIH-distributed document giving advise to grant applicants: " the author of a project proposal must learn all he can about those who will read his proposal and keep these readers in mind constantly as he writes." Since single copies of this advice could be obtained from the Division of Research Grants, NIH, it represents what is considered acceptable and perhaps even desirable by the NIH authority.

86. There are two ways of looking at this advice. For the great majority of grant applicants working in an area of research where the foundation concepts have been firmly established and acceptable to all, this advice tells you about a system with which one might find fault but perhaps also live. It is an altogether different story when the applicant works in an area of science where the foundation is far from being unequivocally established, as it is in the case of cell physiology. It is in this situation that the absolute, unchallengeable power given to the "readers" of the Study Sections, with their long four year tenure, their high visibility, their privileged tradition of recommending their own successors, as well as their own needs for the same NIH money for their own research now being disputed, that the working of the system takes on a significance of truly alarming nature. It is here that the NIH peer review could fall into the same pitfall of generating an "incestuous buddy system" that "stifles new ideas and scientific breakthroughs" as Representative John B. Conlan had described in regard to the NSF system.

B – PRACTICES IN OTHER COUNTRIES (B1-B7)

B1-BRITISH ACADEMY POLICY ON PEER REVIEW AND GRANTS

1.1 Introduction

1. The peer review processes used to assess research grant applications are similar in many respects to those for publication. The basic principle, namely that a judgments should be made by those with demonstrated competence, remains the same in both cases. However, there are four key important, differences of practice:

(i) Grant decisions are based on judgments of prospective quality of the research that will result from an award (if successful), rather than retrospective judgments on the success of research undertaken.

(ii) By contrast with those journals that practice double-blind reviewing, the identify of the applicant is not hidden from the peer reviewers, since track-record is often, and legitimately, used as one of the indicators of potential future success.

(iii) By contrast with journal submissions, there are fewer alternatives to an unsuccessful grant application.

(iv) Public money is involved in the award of grants, either directly or through the tax expenditures from which research charities benefit.

2. These differences do not affect the central value of peer review, namely the making of judgments on the basis of the intellectual and academic quality of the work, but they do raise points where issues of principle arise in the way peer review is practiced.

1.2 Arts of Humanities Research Council (AHRC)

Peer Review Processes

3. AHRC being one of the principal fenders, adopts following procedure of judgment for large grants;

(i) Applications are received and checked for eligibility (e.g. fall within AHRC subject remit and so on),

(ii) Eligible applications are assessed by 3 peer reviewers, one of whom is nominated by the applicant, the other two are appointed by AHRC from its Peer Review College.

(iii) Applications awarded grades from more than one reviewer signifying that they do not meet the AGRC's quality threshold (i.e. its two lowest grades – N and U), are considered unsuccessful and are excluded from any further stages of assessment. Only 5 per cent of applications receive these grades

(iv) The applications satisfying the AHRC's quality threshold (those with one of the following grades – A+, A and RS (resubmission) from at least one of the AHRC College members) receive anonymised comments from the reviewers and are given a 'right to reply', in order to correct any factual misunderstandings.

(v) The applications, together with the reviewers' grades and comments, are considered at a meeting of the appropriate subject-specific panel. Each panel draws up a ranking in priority order, of the applications that it recommends should be funded.

(vi) The panels' recommendations and rankings are considered by the Research Committee, which determines the awards that should be made.

1.3 Similarly procedure adopted by Economical Social Research Council (ESRC) of judgment for large grants is as follows;

(i) Applications are received and checked for eligibility (e.g. do they fall within ESRC remit and so on).

(ii) Normally three to five peer reviewers, one of whom may be nominated by the applicant, assess eligible applications, the other two to four are appointed by the ESRC from across the UK and overseas research communities.

(iii) Applications receiving average grades from peer reviewers of below A- (the ESRC's quality threshold) are considered unsuccessful and are excluded from any further stages of assessment. The process is designed so that a single low grade from one reviewer cannot outweigh more positive reviews from other reviewers. Applications receiving divergent views, with strong support from

several reviewers as well as strong negative views go forward to the next stage. Between 10 to 20 per cent of applications are excluded at this stage.

(iv) Applications in excess of £500K which satisfy the ESRC's quality threshold receive the anonymised comments from the reviewers and are given a 'right to reply', in order to correct any factual misunderstandings.

(v) The remaining applications are sent to two members of the ESRC's Research Grants Board for independent assessment in the light of reviewers' comments and (where applicable) applicants' responses.

(vi) The applications are sifted again, so that the ones with the lowest grades are excluded. Those with large discrepancies between the grades assigned by the two Board assessors, provided that one assessor has given a high funding grade, are also forwarded onto the full Board for consideration. Between 10 to 20 per cent of the remaining applications are excluded at this stage.

(vii) The remaining applications are then considered at a meeting of the ESRC's Research Grants Board which determines the final funding outcome.

1.4 British Academy Peer Review Processes

4. The British Academy itself is a research funder, and makes awards in responsive mode to all branches of the humanities and social sciences. As with the ESRC and the AHRC, the Academy makes sure that the number of peer reviewers is proportionate to the size of the award. Research grant proposals are assessed by subject specialists in the light of references and any external evaluations. Assessors' comments and recommendations are forwarded to a final award committee, which considers the applications and decides on awards to be made in the light of the quality of the competition and the budget available. There may be an interim stage where applications are reviewed by a selection panel. For larger research grants, feedback is given to unsuccessful applicants from the external evaluators (where provided). For other schemes, feedback is provided only if the assessors or the final award committee have specific comments/'constructive advice for the applicant. There is currently no 'right to reply'. Academy fellows undertake this service for free – there is no charge on the public purse. As fellows are elected on the basis of their academic distinction, the academy can be confident that its peer reviewers are leading researchers in the field.

1.5 Support for Peer Review

5. Support for peer review remains high within the research community. 93 per cent of university researchers believe that the peer review system is worthwhile despite the amount of effort involved. While recognizing that peer review is not infallible, the majority of the research community draw attention to the central part that it plays in academic life and hold peer review in high esteem. Despite the generally high esteem in which the peer review process is held, it is difficult to find suitably qualified peer reviewers to serve on either the AHRC or the ESRC's Colleges for peer reviewers. These concerns were supported by the ESRC reviewers, who did not believe that the most talented researchers always engage in peer review activities for the Research Councils, because they are under pressure from their host institutions to focus on publishing their own research.

6. It is felt that the difficulty of recruiting suitably senior scholars for regular peer review activities can lead to a situation in which the legitimacy of grant awards depend upon the representativeness of the reviewers. While considerations of subject, institutional, geographical, age and gender balance are significant, these factors should not override the prime criterion for the selection of peer reviewers- academic distinction. One reason this point is especially important in the case of grants is that there is no alternative to the peer review process that does not have severe disadvantages. Without peer review of individual applications, funders would have to rely upon track record, an approach that would work against the development of new entrants to the research community. The point has been made well by Christopher Schneider from the Deutsche Forschungemeinschaft:

7. "Peers are human. Consequently, peer review has been faulted with all the epithets applied to human nature by disgrunted humans: Unreliable, irreproducible, biased through self-similarity or sheer greed, sexist, ignorant, careless, dishonest. So peer review easily appears as the worst form of underpinning decisions on distributing scarce resources to the best research – until alternatives are seriously considered. Considered, for instance, political correctness, formal bureaucracy, first come first served, lottery systems, citation analysis, journal impact factors, or enlightened arbitrariness. In the author's view therefore, peer review is the best of all known methods of underpinning decisions on competing scientific proposals as long as it is properly managed."

1.6 Few Examples of Good Practice

8. The AHRC has eight subject-specific panels, which meet on a regular basis to consider research grant proposals, together with the grades and comments that have been assigned by the peer reviewers appointed to assess proposals. Each panel determines the final grade to be awarded to proposals and ranks each one in order of priority. The panels' recommendations and rankings are then considered by the AHRC's Research Committee which determines the final funding outcomes. The panel meetings enable the panels to reach independent judgment of the quality of the proposals under consideration, allowing them to consider each proposal on a case-by-case basis, together with the whole range of comments and grades that have been assigned. Under this arrangement, peer reviewers' judgments are treated seriously but not mechanistically: the AHRC is able to avoid a formulaic approach of averaging grades, so one low mark should not automatically rule out a proposal. The panelists were confident that the process meant that they were able to identify the reviewers whose grades tended to be inconsistent (either too high or too low). While this kind of structure involves extra costs, the additional benefits that it brings far outweigh these considerations.

9. The second example is the way in which digital resources are assessed and evaluated. At present, the peer review systems for e-resources are in their infancy. Given the limited funding available, it is essential that peer review systems should be able to identify with precision the resources that are worth creating and sustaining and those that are not. A recent report arising from a study funded by the AHRC, 'Peer review and evaluation of digital resources for the arts and humanities', recommended the establishment of a framework for evaluating the quality, sustainability and impact over time of digital resources for the arts and humanities. The project, led by Professor David Bates and Dr Janet Winters, Institute of Historical Research, recommended *inter alia* that there should be a consistently applied system of peer review of both the intellectual content and technical infrastructure, as well as on- going evaluation through the whole life of a project at different stages in its cycle. It was claimed that the 'value-added' of this whole cycle evaluation process outweighs the increase in peer review costs that would be incurred. The recognition that as disciplines evolved, technical and academic judgments needed to be brought together in ways that has not previously occurred was especially important.

10. The third example is the ESRC's practice (once final award decisions have been reached) of sending reviewers a copy of all the other reviewers' comments on that proposal (in anonymous form), together with a letter informing them of the final funding outcome. This initiative has a number of objectives: improving the transparency of decision-making; improving feedback to reviewers; and helping reviewers to develop their peer-reviewing skills.

1.7 Transparency of Peer Review Practices

11. As with journals, the principle of transparency is important for research funding, indeed more so given the limited number of funders in comparison with journals. This issue was considered carefully by the Borden report in 1990, which recommended that Research Council peer review practices should be more transparent, and highlighted the importance of feed back in order fully to utilize the academic time spent on peer review.

"Councils should not underestimate the degree to which obscurities in their systems can have a depressing effect on their communities and lead to loss of confidence."

12. In recent years, the Research Councils have sought to make their processes more transparent. Their websites contain statements on their strategies for peer review, peer review procedures, the structure and membership of peer review panels and committees, and the membership of the Peer Review Colleges. Steps the Research Councils have tried to take in this direction are endorsed.

13. It is noted that the Research Councils rely on Peer reviewers to provide constructive comments, explaining their grades and views, which they can then send on to applicants. It is important therefore that peer reviewers take the time to provide helpful feedback. In addition, it can often be difficult to give constructive feedback to highly rated proposals that were unsuccessful, because of a shortage of funds. But in these circumstances Research Councils should not feel that they have to invent reasons for rejection other than 'we had to make a choice' and funding was limited. It may be that the councils need to look at ways in which they can draw these issues more prominently to the attention of prospective applicants, in order to raise awareness of these difficulties and better manage expectations.

1.8 Conclusions

14. Peer review system continues to receive widespread support in respect of grant awards. As with publications, the Academy sees no alternative to reliance upon peer review as a process integral to the maintenance of quality. Further Research Council's efforts to make their procedures more transparent are welcome. No doubt, system relies upon the willingness of individual academics to play their part. There is an inevitable element of independent judgment in peer review and hence has to be welcomed. Also Parliamentary Office of Science & Technology (POST) UK which is an office of both Houses of Parliament is charged with providing independent and balanced Analysis of Public Policy issues that have a base in Science & Technology, Annexure II Covers, in detail, the appreciation of Peer Review by POST.

B2-PEER REVIEW IN U.K.

15. Education, Research and Development Directorate, North Bristol, U.K. has recently come out with revised version of R&D Policy and Scientific Peer Review. Observations made therein are expected to result in reasonably fair and transparent review which can be useful and principles can be applied for various scientific fields in Research and Development.

2.1 Introduction

16. It is the policy of NHS Trust, North Bristol that all proposals for health and social care research must be subjected to review by experts in the relevant fields able to offer independent advice on its quality. The following policy formalizes procedures for the scientific peer review of research studies within North Bristol NHS Trust (NBT) in line with the requirements of The Framework for Research Governance in Health and Social Care.

2.2 Scope

17. This policy applies to all research:

i. Regardless of who is providing the funding. Studies may be funded internally, by research councils (e.g. Medical Research Council), charities, the Department of Health, commercial organizations or through other sources.
ii. Regardless of whether NBT is the sponsor of the research
iii. Regardless of the methodology (both quantitative and qualitative).
iv. Regardless of who is leading the research. I.e. The Chief investigator of the project may be a staff member of NBT or based in another organization such as another NHS Trust or University.
v. Regardless of whether the research is being undertaken for undergraduate and postgraduate qualifications.

18. For most research, independent scientific peer review is likely to have been undertaken during the development of the study and therefore will not need to be repeated by the Trust. This is likely to be the case for:

i. Research funded by major non-commercial funders (e.g. Medical Research Council, Welcome Trust)
ii. Commercial clinical trials
iii. Student research

19. Therefore, the NBT scientific peer review process will only be required for research where there has not already been sufficient review. This is more likely to be the case for:

i. NHS 'own account' research - i.e. Smaller scale studies that do not have external funding.
ii. Externally funded research from sources where award of funding does not include sufficient independent review of methodology. This can include research funded by small charities or non-research statutory bodies.

20. The Research Governance Framework states that 'Scientific peer review should be commensurate with the scale of the research'. Therefore the R&D Office may request review from an external expert source, in the following circumstances:

i. The research is complex or involves a subject matter where there is no research experience within NBT.
ii. The research budget exceeds 20,000 pounds in total in either direct research costs, treatment costs or service support costs.
iii. There is other reason to suggest that the research is of particular methodological complexity
iv. Their is any other reason why review by the Bristol Research Development Support Unit, or another expert within NBT would not be appropriate or sufficiently independent.

2.3 The Policy

i. Researchers are required to complete a question on the standard research ethics application form indicating the level of scientific peer review that has been undertaken.
ii. Researchers are encouraged to obtain peer review, wherever possible, prior to submission of their Research Ethics application, in case outcome of the review results in amendment to their protocol.

iii. As part of the NBT organizational approval process (which includes the submission of a copy of the full Research Ethics Application to the R&D Office), the R&D Office will check that the requirements for scientific peer review have been met.

iv. If the requirements have been met, the R&D Office will approve the research (subject to other appropriate Research Governance Checks).

v. If peer review is required, the R&D Office will provide the necessary information to the Bristol Research Development Support Unit who will undertake/coordinate the review, requesting support from experts within the specialty to contribute where necessary.

21. In line with good practice guidance from the national R&D Forum Research Governance Working Group, a proforma will be used (enclosed) and focus on:

(i) Does the research have a stated hypothesis or research question?

(ii) Are the stated objectives clear?

(iii) Is there a clear design and methodology?

(iv) Has the relevant literature been examined and incorporated into the study design?

(v) Has a case been made for the clinical/service significance?

(vi) Is there justification for the sample size? There should be justification for sample size in both qualitative and quantitative research, and in the case of quantitative research this should be backed up with a statistical calculation with stated power and P value, and /or named expert statistical advice

(vii) Is the sample representative of the target population?

(viii) Is the proposed date analysis described and appropriate?

(ix) What are the arrangements for project management, including formation of a project steering group?

(x) Are the outcomes of the study stated and appropriate?

(xi) Is the time scale realistic and are the project's objectives likely to be met?

(xii) Are there plans for dissemination of the research findings to patients/service users, carers, staff, participants and other key stakeholders?

22. The outcome of the review, and any related comments will form part of the final NBT approval decision made by the R&D Office. The Research Committee will act as the arbitrator of any final decisions relating to the research following peer review, carried out at the committee or by chair's action.

2.4 Monitoring/Auditing

23. Appropriate peer review is a requirement of the R&D approval process. Information regarding the peer review undertaken for a study will be held on the R&D Office Research Projects database and be included in the audit/monitoring of studies, covered by a separate policy.

North Bristol NHS Trust Peer Review Form

Lead Investigator: Reviewer:

Type of Project: (tick as appropriate, more than one option may be selected)

Student ☐ Pilot ☐ Full ☐ Multicentre ☐

Assessment Criteria	Yes	No	Unclear	N/A
1. SCIENTIFIC QUALITY				
1a. Study Design				
• Does the research have a clear protocol?	☐	☐	☐	☐
• Is the research question or hypothesis clearly stated?	☐	☐	☐	☐
• Are the project objectives described?	☐	☐	☐	☐
• Are the objectives realistic?	☐	☐	☐	☐
• Has other relevant research been reviewed?	☐	☐	☐	☐
• Is the methodology appropriate to the research question?	☐	☐	☐	☐
• Have the methods of measurement been described?	☐	☐	☐	☐
• Has the reliability and validity of measurement been reviewed?	☐	☐	☐	☐
• If available, are validated scales of measurement being used?	☐	☐	☐	☐
1b. Study sample and data analysis				
• Is the proposed population group appropriately representative?	☐	☐	☐	☐
• Is the sample size justified and realistic?	☐	☐	☐	☐
• Are the methods of data analysis (statistical or otherwise) described and appropriate?	☐	☐	☐	☐
1c. Ethical considerations				
• If ethical review by the Local Research Ethics Committee is not being sought has appropriate justification been given?	☐	☐	☐	☐
OVERALL RATING OF SCIENTIFIC QUALITY (Scale of 1-5 were 1 indicates poor scientific quality, 3 acceptable scientific quality and 5 excellent scientific quality)				☐

	Yes	No	Unclear	N/A
2. RELEVANCE, IMPACT AND IMPORTANCE				
2a. Relevance				
• Does the project address issues of relevance to local/ national NHS needs and priorities	☐	☐	☐	☐
2b. Impact and importance				
• Are the expected values and benefits of the research clear?	☐	☐	☐	☐
• Will the research add to current knowledge or have training value?	☐	☐	☐	☐
• Is the research generalisable i.e. have potential application beyond the Trust?	☐	☐	☐	☐
• Will the findings lead to significant health gains and/or benefit the Trust/ NHS/ population?	☐	☐	☐	☐
2c. Dissemination				
• Do the researchers intend to disseminate research findings in an appropriate fashion?	☐	☐	☐	☐
• Will the results of the research be made available to research participants?	☐	☐	☐	☐
OVERALL RATING OF LIKELY IMPACT (Scale 1-5 were 1 indicates a proposal of little impact, 3 of moderate impact and 5 a proposal of significant impact)				☐

		Yes	No	Un-clear	N/A
10	**3. FEASIBILITY AND RESOURCE UTILISATION**				
	3a. Feasibility				
	• Is the research feasible within the local context?	☐	☐	☐	☐
	• Is the project feasible within the timeframe and resources proposed?	☐	☐	☐	☐
	3b. Resource utilisation				
	• Does the Trust/Directorate have the capacity to support the project at this time?	☐	☐	☐	☐
	• Are the resource implications to the Directorate reasonable and acceptable?	☐	☐	☐	☐
	• Have appropriate support departments been notified/ agreed to support this research?	☐	☐	☐	☐
	• Is the proposed research likely to put the Trust, Trust staff, participants in the research or the applicants at risk, which are such that these should specifically be taken into account when deciding whether or not to support the research?	☐	☐	☐	☐
	• Would the work provide good value for money?	☐	☐	☐	☐
	OVERALL RATING OF VALUE FOR MONEY (Scale 1-5 were 1 indicates poor value for money. 3 acceptable value for money and 5 excellent value for money)				☐

		Yes	No	Un-clear	N/A
11	**4. PEOPLE**				
	• Does the applicant have (or have access to) the necessary experience and expertise to undertake the research?	☐	☐	☐	☐
	• Do the researchers have the necessary time and resources to undertake the research?	☐	☐	☐	☐
	• Do all researchers have appropriate employment contracts to undertake research in NBT?	☐	☐	☐	☐
	• Where relevant, has a multidisciplinary and multi-professional approach to addressing the research question been adopted?	☐	☐	☐	☐
12	**5. CONSUMER INVOLVEMENT**				
	• Where relevant, have patients or their representatives been involved in this project?	☐	☐	☐	☐
	OVERALL RATING OF PROPOSAL (Scale 1-5 were 1 indicates a poor research proposal, 3 an acceptable proposal and 5 an excellent research proposal)				☐

Comments

Please provide comments you may wish to make on the proposal, particularly any suggestions as to how the project could be amended. Your comments will be used to provide feedback to the principle investigator.

Approve	☐	*Approve with amendments described above:*	☐	*Resubmit after amendments as described above:*	☐	*Reject:*	☐

Signature: Date:

B3-PEER REVIEW MECHANISM FOR FUNDING MEDICAL RESEARCH (CANADA)

24. The application of scientific thinking and method to medical research over the past century has led to the development of a reviewing process for medical research called – Peer Review. This process has become the standard method by which proposed research projects are approved and funded by most granting agencies. Extract on the subject that follows is from a paper on the subject brought about by National Medical Advisor, Thyroid Foundation of Canada (La Foundation Canadienne da la Francaise). The paper outlined, for the members of the Foundation, the mechanics of the Peer Review process.

25. Basically the peer review process ensures that any proposed research project is approved by a group of experts in the field of the proposed project who are better qualified than the experts in the field to make decisions regarding the merit of any given project and whether it should be funded? The peer review process looks at the quality of the proposed research and compares it to other research and the universe of knowledge in the subject area. An integral part of the process involves reviewing the ethics of the project. Without the peer review process research funding would be distributed in a haphazard manner based on chance, pressure groups and local politics rather than on the scientific and ethical merit of the project. No major granting agency for research funds allocates funding except on the basis of peer review and major medical institutions across the country allow research, which has not met ethical and quality standards to proceed.

3.1 Process

26. The steps involved for any researcher wishing to undertake research and apply for research funds include (i) development of the concept, (ii) completion of an application, (iii) institutional review and (iv) granting agency review.

3.2 Concept Development

27. The basis of all research is development or an idea or hypothesis. Once the researcher has clearly defined the hypothesis, the next essential step is to review the literature on related medical research to see whether anyone else has carried out the experiment previously and what they found.

3.3 Research Application

28. Having confirmed that no one else has proven the idea or hypothesis, the researcher wishing to carry out research in a teaching institution or apply for funds must complete a research application form. Usually the form to be completed for review by the institutional committee is different from that to be completed for the granting agencies though they are very similar. The application form must include a description of the materials, i.e. the animals, people, tissue, etc. that the experiment will be conducted upon. The description of the methods of testing or experimentation must be included along with the possible consequences of any of the experimentation procedures on the animal subjects being investigated.

29. The researcher must outline his scientific and statistical methods for evaluating results and must clearly state the hoped-for benefits of a successful experiment or project. For granting agencies, a breakdown of projected cost for the research project must be included with the application. For experiments involving human subjects, proof that a mechanism exists for adequately informing the human subjects of the details and risks involved in the completion of an "informed consent form" must be provided before either institutional review committees or grant review committees will look at the project.

3.4 Institutional Review

30. All major medical teaching and research institutions have in their by-laws stipulations that all research carried out on the premises must be approved by an institutional review committee. There may in fact be several committees. One of the major roles of the institutional review committee (s) is to look at the ethical aspects of any experiment, be it on humans or animals. In some institutional by laws at many granting

agencies, such committees must have adequate representation from the lay public, either a clergyman or a legal expert.

31. Specific guidelines have been drawn up by international bodies in the past for the use of committees looking at the ethical aspects of medical research and these guidelines are strictly adhered to. In addition to examining the ethics of a submitted project, institutional committees also frequently examine methodology and may request peer review by outside experts. Institutional committees also act as a watchdog for the misuse of institutional resources.

3.5 Granting Agency Review

32. All major granting agencies work on the peer review process. Most of them have subcommittees made up of experts in various fields which examine in detail the quality of the research projects being submitted. Major granting agencies do not accept any application for research funds unless they have been approved by institutional committees. Some of the major granting agencies such as the Medical Research Council have strict guidelines for the makeup of institutional ethics review committees.

33. Since, frequently, the amount of money available for research is insufficient to meet all of the requests for funding, most granting agencies require that their committees of experts decide which projects should be funded.

3.6 Concluding Remarks

34. Peer review processes in Canada to ensure the optimal utilization of research funds are clearly outlined. Mechanisms are reported to use the limited funds efficiently and encourage scientific thinking and methodology in Canadian researchers.

B4-PEER REVIEW EXPERIENCE IN JAPAN

35. Ryokichi Hirono, Professor emeritus, Seikei University has covered above topic in detail in a paper brought in January, 2007 in Jakarta. Outlines of the topics broadly covered are Introduction, History of OECD organization for economic co-operator and Department Peer Review in Japan, Peer Review Mechanism, Major findings and some salient impacts of OECD Peer Reviews, Merits of OECD PR Process and lastly some lessons for Non-member countries from OECD Peer Review Mechanism.

4.1 Introduction

36. OEEC (Organisation for European Economic Cooperation) was established in 1948 under the Marshal Plan. Japan participated in OEEC's Development assistance Group in 1960. Further OEEC was reorganized into OECD in 1961 and Japan got its full membership in April 1964 acceding to the principle of current and capital Account Liberalization. Japan made positive participation in the OECD's Ministerial Meetings and all standing committees and their subsidiaries, maintaining the second largest financial contribution and taking some initiatives in setting guidelines on investment and ODA (OEEC's Development Assistance) in developing countries.

4.2 History

37. Among many OECD peer reviews, Economic Survey, conducted every 18 months, and ODA Review, conducted every 3-4 years, have been most long-standing considered most important, and most publicized and well-known in Japan, as growing pressures of economic globalization have heightened the importance among OECD members for domestic macro-economic and structural policy and external policy coordination, as well as for learning from other countries experiences and steering public opinion in favor of some painful domestic reforms essential to long-term economic growth and well being of the people in their respective countries and the world over.

38. OECD's Regulatory Reform has also become increasingly important in Japan and other OECD countries, as their economic growth began to depend highly on deregulation and competition policies at home. Japan, together with Mexico, was the first member country in 2004 to agree to expose themselves to OECD monitoring process.

39. With a rapid process of industrialization in the 1960s and 70s, there was growing concern in Japan and elsewhere in OECD member countries, particularly among civil society groups, with environmental protection, culminating in an increasing need for Environmental Performance Review and an OECD consensus on PPP (Polluter Pay Principle).

40. Going for Growth has now become a regular policy reform monitoring report covering all OECD member countries including Japan.

4.3 Peer Review (PR) Mechanism in Japan

41. As in other countries, OECD PR mechanism in Japan starts with preparatory, consultation and assessment phases, followed by the publication of PR reports by OECD. Monitoring of progress made is included in all PRs.

42. With groundwork and major issues for PR prepared by the OECD mission with secretariat assistance and the memorandum on the issues prepared by Japan, a questionnaire is developed, often in consultation with Japanese delegation to OECD and a few other experts in Japan, for agenda setting for mission consultation which ordinarily lasts one week in Japan.

43. PR mission carries out an intensive dialogue with the Government of Japan (GOJ), academics and representatives of industry and civil society groups including trade unions, farmers and consumer groups, if found necessary. The mission, with secretariat assistance makes detailed performance analysis and prepares a final draft report, including conclusions and recommendations.

44. All OECD PR reports of Japan have been assessed by appropriate committees at their respective plenary meetings made up of all 30 member countries. For example, OECD's Economic Development and Review Committee on a draft report of Economic Survey of Japan, OECD's special group on regulatory reform for regulatory reform of Japan, development assistance committee for Japan's official development assistance,

working party on environmental performance for environmental performance Review of Japan, and Economic Policy Committee for Economic Policy Reform.

4.4 Major Findings of OECD PRs

45. Economic Survey of Japan 2006

i) Successfully implementing a new monetary policy framework: enhance the transparency of monetary policy, avoid an early and significant rise in long-term interest rates, scale back the role of public financial institutions and accelerate the privatization of Japan Post.

ii) Achieving fiscal consolidation: reduce the still-large fiscal deficits through continued spending restraint and reducing public investment, some increase in consumption tax rate, and achieve a primary budget surplus by the early 2010s.

iii) Reducing income inequality and relative poverty: reduce increased dualism in the labour market through reducing the protection of regular workers and increased social spending for vulnerable groups such as single parents.

iv) Upgrading the national innovation system to promote productivity growth through improving R&D system and education system, enhancing linkage between public and private research institutions and strengthening competition particularly in the network industries.

v) Strengthening the integration of Japan in the world economy through enhancing import penetration, the stock of FDI and the inflow of foreign workers as well as through reducing barriers in agriculture.

46. Going for Growth 2006

(i) Furthering service liberalization through strengthening of law enforcement and imposing heavier sanction, extending nationwide those regulatory reform measures applicable to special zones and promotion of competition in network industries, e.g. raising surcharge rate from 6 to 10% of the sales of the goods concerned and enlarging the free choice of electricity providers from 1/3 to 2/3 of consumers.

(ii) Reducing producer support to agriculture by shifting market price support to direct payments and allowing entry of joint stock companies, e.g. government decision to allow on leased farmland.

(iii) Easing employment protection of regular workers, e.g. white collar exemption law withdrawn and revision of labour laws in favour of equal treatment of non-regular workers endorsed by government. white collar exemption law withdrawn and revision of labour laws in favour of equal treatment of non-regular workers endorsed by government.

(iv) Reforming the financial sector by scaling public financial institutions, requiring banks to resolve non-performing loan problem and strengthening their capital bases to overcome their remaining weaknesses, e.g., government targets of halving NPAs exceeded.

(v) Removing impediments to FDI by following government's own plan to double FDI stock over 5 years, e.g., revising the commercial code to facilitate mergers and acquisitions by foreign companies using their Japanese subsidiaries.

4.5 Few Salient impacts of OECD PRs

47. Environmental Performance Review

i) Introduction of Polluter Pay Principle (PPP) in Japanese environmental legislations and national and local Agenda 21 and their effective implementation since 1991.

ii) Japan's initiative in 1997 for the Kyoto Protocol under the United Nations Framework Convention for Climate Change (UNFCCC), encouraged by EnvPR.

48. Regulatory Reform Review, 1999

(i) Installation of the comprehensive Regulatory Reform commission in 2002.

(ii) Adoption of the National Plan for doubling FDI inflows, 2003

(iii) Enactment of a law on the privatization of Japan Post in 2006

(iv) Empowerment of the Fair Trade Commission in 2006

49. Official Development Assistance Review, 2003

i) Mainstreaming MDGs in 2003

ii) Institutional reforms for ODA implementation, 2006

iii) Improving ODA effectiveness through harmonisation, alignment and partnership in 2006

50. Economic Survey of Japan, 2005

(i) Ending the Bank of Japan's exceedingly cautious zero interest rate policy in 2006

(ii) Accelerating fiscal reform and raising consumption tax rate, debate ongoing

(iii) Equal treatment of non-regular workforce in 2007

51. Some Recommendations found difficult and more time needed for policy reform and effective implementation

i) Reduction of farm support programmes and increase of farm imports as share of farm imports as share of domestic consumption through tariff reduction (tariffisation of quantitative import restrictions has already been done in accordance with GATT accord)

ii) Substantial increase of penalty rates charged to violation of the Fair Trade Law

iii) Streamlining the regulatory mechanism independent of the promotion function for telecommunication and information technology market

iv) Broadening the use of the specific road-related taxes for non-road expenditures

4.6 Merits of OECD Peer Review

i) Made GOJ feel more at ease and less costly in adapting those policy and implementation reforms from the tried and tested experiences of other OECD countries.

ii) Assisted GOJ to win support at home for difficult policy decisions and measures by showing what other counties were doing, as PR policy and institutional recommendations came from a credible, like minded

international organization, and finally as PR mechanism has been followed in other international organizations such as EU, IMF and WTO.

iii) Enhanced Japan's policy ownership, as PR policy recordation have never been legally binding.

iv) Publication of PR results has exerted pressures on GOJ through parliamentary debates, mass media and civil society groups to seriously consider those issues identified and put their recommendations into practices.

v) Monitoring of PR recommendations enhanced chances of faster and more effective implementation.

vi) OECD PR mechanism, by allowing GOJ to join PRs of other member countries, has enhanced opportunities for them to learn from the policy successes and failures elsewhere and thus to coordinate their domestic policies with the rest of OECD for their own benefits.

4.7 Need for Improving OECD PR

i) Monitoring should be more frequent for all PR mechanism, as is done through annual Economic Policy Reform Paper by EPC.

ii) Given financial constraints on OECD, the preparatory phase could enhance credibility by working in close consultation with the World Bank, WTO and other international organizations as well as with research institutions in reviewed countries better equipped with policy research capability. The entire phase could be even commissioned to such research organizations.

iii) While the consultation phase is vital to making both policy analysis and recommendations satisfactory to the review mission and valuable to reviewed countries the phase would involve intensive dialogue with so many stakeholders both within and outside the reviewed governments. To reduce time burden on both parties, questionnaires could be both more concise and focused, by introducing some common standards and indicators amenable to quantitative measurements, e.g. tax revenues, national and external debts and annual debt servicing as % of GDP.

iv) In countries as in Japan where English is not a mother tongue, the use of English language during the OECD PR process would increase not

only the financial burden and time waste on the government of reviewed countries, but also there may be some interpretative prejudices introduced. The enormity of the cost and time consuming trouble should be easily understood by all OECD countries if they had to use Japanese or Chinese language as a working language. To avoid this, the use of preferred language be required except for the assessment phase, which requires OECD to be multi-lingual institution.

4.8 Lessons for Non-Member Countries (NMCs)

i) Better understanding of the OECD PR process required for effective installation of OECD PR: Why, what, how and cost-benefits to NMCs.

ii) Support to capacity building of reviewed country by OECD through bilateral and multilateral ODA is essential in many areas of cooperation to make OECD PR meaningful and welcome, e.g., comprehensive economic and social data collection, analysis and publication and macro-economic, structural, social and environmental policy formulation, implementation, monitoring and evaluation.

iii) Need for NMCs to accelerate legislative and enforcement reforms such as free parliamentary debates and institutional arrangements such as a broader participation of multi-stakeholders in all OECD PR process, particularly in preparatory and consultation and monitoring phases.

iv) Need for NMC ownership throughout OECD PR process so that various stakeholders in reviewed countries would find the process as enhancing their own benefits in terms of macro-economic stability, long-term economic growth, social equity and environmental protection.

B5-POLICY MIX PEER REVIEW
(Sweden, Romania, Spain)

5.1 Introduction

52. Three CREST (Scientific and Technical Research Committee) members, Sweden, Romania and Spain had volunteered to have their policies directed at achieving the Barcelona targets reviewed. The policy mix peer review is part of the Lisbon process. It follows the Open Method of Co-ordination (OMC). March 2006 report constitutes the report of the Policy Mix Group set up by CREST within the context of the Open Method of Co-ordination. The overall remit of the group is to encourage mutual learning amongst Member States concerning the policy mixes needed to improve overall R&D and innovation system performance. The main objective of the Policy Mix Group in 2005 was to pilot and develop a peer review process capable of acting as an instrument of mutual learning within the context of the OMC. The aim of the peer review process was to help countries better understand the policy mixes needed to raise R&D intensity by improving overall innovation system performance. In contrast to 'conventional', resource intensive peer reviews aimed primarily at producing specific policy recommendations for individual countries, the emphasis in this 'light' exercise was to encourage the sharing of information about policy-related issues between senior policymakers and to generate generic lessons for the formulation and implementation of effective policy mixes.

5.2 Peer Review Process

53. The main objective of the Policy Mix Group in 2005 was to pilot and develop a peer review process capable of acting as an instrument of mutual learning within the context of the Open Method of Coordination. The aim of the peer review process was to help countries better understand the policy mixes needed to raise R&D intensity by improving overall innovation system performance. In contrast to 'conventional', resource intensive peer reviews aimed primarily at producing specific policy recommendations for individual countries, the emphasis in this 'light' exercise was to encourage the sharing of information about policy-related issues between senior policy makers and to generate generic lessons for the formulation and implementation of effective policy mixes.

54. The overall process commenced with the self-nomination of three 'review' countries and interested 'examiner' countries. This was followed by the preparation of a background report on each of the review countries, utilizing publicly available information and updated and amended as necessary by representatives from the review countries. In turn, these reports were made available as background material to the examiner countries, in preparation for a visit to each review country by teams composed of representatives from at least three examiner countries, and an independent consultant. These teams held a series of discussions with a variety of R&D and an innovation policymakers and key stakeholders in each country. The commentaries of these teams were then recorded in three country reports and discussed with the review countries in a series of feedback missions designed to validate the findings of the country reports and deepen understanding and mutual learning. All three reports were then presented and discussed by CREST representatives at a formal Peer Review Meeting in Brussels. Subsequently, the key issues to emerge concerning the formulation of effective policy mixes were summarized for presentation to CREST and incorporated in this final synthesis report.

55. During the course of the whole exercise, a simple analytical framework linking different domains of an innovation system was used to structure both discussions and report. Policy mixes were conceived as the aggregate of policies affecting four major domains: Human Resources; the Science Base; Business R&D and Innovation; and Economic and Market Development. The governance system linking policies in all these domains was also of central interest. Using this scheme, the background reports concentrated on the major innovation system performance indicators in each domain; the major challenges facing each innovation system; the governance structures within which policies were formulated and implemented; major policy objectives and implementation strategies in each domain; and, if available, evidence of policy effectiveness. The reports of the review teams then focused on overviews of the three national innovation systems and policy mixes; the commentary of the review teams on these mixes; and generic lessons for the formulation and implementation of effective mixes. In this final synthesis report, the results of the country reports are presented, followed by a separate section focusing specifically on broader, generic lessons. A concluding section contains recommendations concerning the future of the Peer Review exercise.

5.3 Highlights of Peer Reviews

Sweden

56. Sweden has a strong R&D system and policy formulation is informed by an overt, holistic innovation system approach. Current preoccupations are on countering external threats (market liberalisation and the threat of footloose R&D capacity) and internal threats (the Swedish equivalent of the 'European Paradox' and the relatively low formation of New Technology Based Firms (NTBFs). The policy response has been to adopt a comprehensive policy mix spanning initiatives focused on Human Resources and the Science Base (to counter the threat of footloose capital by making Sweden an attractive knowledge-based environment); on Science-Industry-Market linkages (to improve the efficiency of the exploitation of knowledge and counter the 'Swedish Paradox'); on procurement policies in order to strengthen public-private partnerships (again as a counter to the 'Swedish Paradox'); on policies focusing on NTBF formation in order to ensure the continuous renewal of R&D and innovative capacity; and a continued focus on, and commitment to, policies promoting liberalization, deregulation and competition.

57. Policy suggestions include greater efforts to strengthen the science base by increasing the proportion of funds available to universities via competitive processes; developing the relatively small research Institute sector as a means of improving linkages between the science base and industry; broadening the range of policies focused on the task of stimulating R&D and innovation activities in SMEs and encouraging the formation and growth of New Technology Based Firms (NTBFs)' and reconsidering the use of fiscal incentives as a means of stimulating R&D activities, particularly amongst SMEs.

Spain

58. Spain's R&D and innovation system has improved significantly over the last decade, especially in terms of strengthening human resource development and the science base, though there is still room for improvement if performance indicator levels are to reach EU average levels. Business R&D and innovation performance in particular

is still relatively weak. Policies designed to build on past efforts are now firmly embedded within a national reform agenda that recognizes the central importance of R&D and innovation and is based on a perceptive diagnosis of the R&D and innovation system and national needs. The current goal is to maintain a 25% per annum increase in the civil R&D and innovation budget and reach a target for R&D of 2% of GDP by 2010 (45% public expenditure; 55% private expenditure), though there has also been a marked increase in the emphasis put upon the need to improve the innovative performance of industry, particularly SMEs. Large-scale investments in actions designed to promote the diffusion of ICTs and improve the information society infrastructure are also foreseen.

59. Policy suggestions include not letting the shift in emphasis to innovation detract from continued efforts to strengthen the science base; improving the prospects for research excellence by expanding the use of international peer review in proposal selection procedures; seeking a balance between satisfying the need of the R&D community and concentrating scarce resources in areas of most relevance to the future prosperity of the country; improving the prospects for higher BERD (Private Sector R&D) by expanding measures aimed at increasing the demand for R&D in industry; and ensuring that adequate mechanisms are increasing the demand for R&D in industry and ensuring that adequate mechanisms are in place to align national and regional interests in the development of appropriate policies at these levels.

Romania

60. Romania has a relatively weak R&D and innovation system that suffered during the early transition years and has only recently shown signs of recovery. Most R&D is performed in a Research Institute sector that consists of a large number of sector-based organizations performing applied R&D, many of which are state-owned. Most suffered during the transition years from low state funding and limited demand for their services. Despite the fact that industry performs little R&D, it is primarily low-to medium-tech and is not attuned to innovation. Recent policy initiatives, however, have demonstrated that Romania is strongly committed to reaching the Barcelona targets by 2010, and public policies have focused on strengthening human resources and research capacity in the Research Institute and University sectors, with fewer measures geared towards the development of innovative performance in industry. On a macroeconomic level,

however, although many of the legal and institutional frameworks necessary for the effective operation of a market economy and entry to the EU in 2007 are in place, progress has been slow and obstacles still remain.

61. Policy suggestions include maintaining a strong focus on the framework conditions needed for the establishment of a fully functional market economy; raising the profile of R&D and innovation across the Romanian system of governance, stressing in particular their importance for industrial and economic development; rationalizing the structure of the Research Institute sector and improving the research capacity of universities; and involving key stakeholders in a vision building exercise and setting ambitious but realistic targets.

5.4 Generic Lessons

62. A series of generic lessons pertinent to the formulation and implementation of effective policy mixes emerged from the country reviews. One cluster of lessons concerned the process of policy formulation itself. Not unexpectedly, these focused on the importance of adopting holistic approaches to policy development; utilizing sophisticated analyses of strengths, weaknesses, opportunities and threats; and building on strategic intelligence furnished by comprehensive monitoring and evaluation systems and inclusive, vision-generating initiatives such as foresight exercise.

63. Another cluster of lessons concerned the governance of innovation systems. Here it was clear that the tasks and responsibilities of the different ministries and agencies involved in the development and implementation of policy mixes have to be clearly delineated, with adequate mechanisms in place to ensure coordination and avoid conflicts and overlaps. Equally crucial was the need to secure high-level commitment to the central importance of R&D and innovation in future growth strategies and to ensure that this commitment was effectively communicated to all relevant quarters of the governance system.

64. A number of key issues concerning the balances that have to be struck in the formulation of policy mixes also emerged. These included the need to strike a balance

between competitive and non-competitive R&D funding in the science base in order to promote both excellence and stability, and the need to find a balance between concentrating funds on areas of strategic importance and satisfying the funding needs of a broad spread of researchers. Balancing the respective roles of universities and research institutes within innovation systems is also likely to become increasingly important as R&D performing organizations in the science base strive to fulfill educational, research and industrial linkage missions. At a different level, it will also be important to ensure that regional policies concerning R&D and innovation, when considered in aggregate, are alignment with national priorities and policies.

65. Looking across all three countries, a set of common priorities emerged – issues that are likely to be important for many other countries too. Foremost amongst these were: the need to improve the overall effectiveness of R&D and innovation systems by supporting improved linkages between the science base and industry; the need to encourage R&D and innovation activities in SMEs; and the need to stimulate R&D via effective procurement policies linking supply and demand.

66. Finally, the importance of starting positions in the choice of development paths was strongly highlighted by the experiences of the three countries under review. Despite the existence of some common priorities, the exact composition of the policy mixes chosen in different settings is strongly contextual, with historical starting positions largely determining the choice of development options open to countries and the likelihood of their success.

5.5 Conclusion

67. Based on the warm reception given to the exercise by members of the Policy Mix Working Group in particular by representatives of the 'review' and 'examiner' countries, the Group recommends that the peer review exercise be repeated in future cycles of the OMC. If this is acceptable to CREST Member States should again be invited to participate as 'review' and 'examiner' countries. The aim should then be to keep the exercise light, but to offer review countries options such as a continued focus on mutual learning and the search for generic lessons, or a greater focus on the production of country-specific recommendations. Consideration should also be given to the structure

of the 'examiner' teams. One option would be to involve both high-level and more junior policymakers in these teams in order to assist high-level members in their tasks and to spread learning within their own systems. Other improvements to the process might include field visits during the preparation of the background briefing documents, the establishment of 'feedback' and 'deepening' missions as intrinsic parts of the review process, and spreading the process over a complete 12-month period. It would also be advisable to link the OMC peer review activities with the peer reviews of national policy mixes scheduled to take place under the auspices of the OECD.

B6-EXPANDING ROLE OF PEER REVIEW IN SCIENCE POLICY (USA)

6.1 Introduction

68. Perceiving success of peer review, reformers have sought to harness peer review to help produce knowledge on which policy makers can rely, for the ultimate purposes of improving decisions, reducing the occurrence of legal challenges and other procedural obstacles, and achieving other political goals. This paper explores what appears to be the increasing domain of peer review processes in science policy. It is an early portion of a two-pronged research agenda that seeks to elaborate both the logical structure and the detailed procedures of peer review and the use of scientific expertise in the policy process. In elaborating peer review's logical structure, the project builds on previous work on the logical structure of science policy more generally. In elaborating the detailed procedures of peer review, the agenda extends an approach to studying science and scientists by following them out of the laboratory and into arenas in which they are called upon to come to judgments in a more public and accountable way. It also extends an approach to studying science and scientists that emphasize observing how, through their rhetoric as well as the establishment of policies and procedures, scientists attempt to demarcate their vision of scientific from non-scientific activities.

69. Such detailed scrutiny can yield a more complete, scholarly understanding of consensus and consensus formation in science, as well as create precise, policy-relevant knowledge about the decision making of expert advisory committee. Ultimately, the project will synthesize both perspectives in a way that has been done for "policy for science". Paper provides preliminary descriptive work for the agenda. It begins by defining peer review and recounting a very brief history of its use by the federal government of the United States. It then describes the expansion of its domain in several areas: the allocation of federal funds, the evaluation of research programs, the evaluation of knowledge inputs to policy, the admission of expert testimony in federal courts, and in state science policy. The paper concludes with a brief evaluation of these trends.

70. Various definitions or descriptions of peer review contained the fundamental concept of a review of technical or scientific merit by individuals with sufficient technical competence and no unresolved conflict of interest. This concept is sufficient for the purpose of paper, but key to its further usefulness is the specification of exactly what constitutes technical or scientific merit, who the competent persons are and how are they selected, what conflicts of interest need to be resolved in which ways, and how the process of review itself relates to actual outcomes. Over the long span of history, peer review as a method of evaluation has clearly expanded its domain. Among the earliest examples of peer review for proposed research projects in the United states include the Smithsonian Institution, which created an advisory committee for reviewing and recommending funding proposals in the 1840s; the Navy Consulting Board, which in 1915 began reviewing requests for funding from inventors and the Hygienic Laboratory, predecessor to the National Institutes of Health (NIH), which pioneered peer review in 1902 with a congressionally mandated advisory committee. The National Cancer Act of 1937 and the Public Health Service Act of 1944 legitimated the use of advisory councils to award grants to extramural researchers, and NIH fully established its peer review system with the creation of its Division of Research Grants and the original review groups after World War II. At the National Science Foundation (NSF), peer review was only implicit at the start, although NSF's governing body, the National Science Board (NSB), understood that after staff members evaluated proposals, they would send them to advisory bodies before presenting them to NSB for statutory approval.

6.2 Federal Funds Allocation

71. One of the critical conflicts in science policy at the time of the founding of NSF was between different schemes for allocating federal research and development (R&D) dollars: Would the wartime practice of distributing funds only to the elite universities continue, or would there be some geographic formula (as had been the mode with agricultural research) that might redress some of the distibutional inequities? Although the former model triumphed, and was buttressed by the peer review system, the political demand for the redress of geographic inequities did not disappear. Instead, it manifested itself, in part, in the earmarking of federal appropriations to specific projects. Thus, earmarking (or pork barreling) is seen as competitive with peer review, and the level of

earmarks are anxiously traced in the science policy community. Identifying the amount of peer-reviewed research within total R & D is difficult. A generation ago, Harvey Brooks (1982) estimated the fraction of peer-reviewed research in total national R & D expenditures at about 5%.

72. Since FY 1996, the Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB) have jointly provided annual direction to agencies encouraging them to emphasize the funding of peer-reviewed research over non-peer-reviewed research but there is no direct way of judging whether or not this directive has had any impact. The Clinton Administration's FY 2001 budget proposal reports that $26 billion of the nearly $83 billion total federal R & D (31.4%) was peer reviewed in FY 2000. This level of peer reviewed R & D corresponds to about 10% of national expenditures. Again assuming that no private funds are peer reviewed, this rate is double what Brooks estimated, despite the nearly two-fold increase in the relative share of private funds in the national account. There has thus likely been a significant increase in the share of federal R & D funds that are subject to peer review.

73. Some recently established federal funding programs by the U.S. Department of Agriculture, the National Academy of Science, the Environmental Protection Agency and the Advanced Technology Program (ATP) of the Department of Commerce tout peer review as an important and novel component.

6.3 Evaluation of Research Programs

74. The jurisdiction of peer review may be further increasing among agencies that sponsor research with the increasing importance of the Government Performance and Results Act (GPRA), which requires federal agencies to engage in program and performance assessment. Because the results of research funding are hard to quantify, research agencies rely on peer assessments (either prospectively or retrospectively) to justify and evaluate their performance. The National Science and Technology Council (NSTC 1996) finds that evaluating current programs in individual agencies, merit review based on peer evaluation will continue to be the primary vehicle for assessing the excellence and conduct of science at the cutting edge. Such review can occur not only prospectively, as with current peer review for funding allocations, but from of merit review with peer evaluation can also be used for retrospective evaluation of an agency's

fundamental science program or programs. NSTC recommends that assessors performing this evaluation should include input from stakeholders, next stage users, and or customers who will use or have a stake in the results of the research being done, in addition to those with relevant scientific expertise and experience in the type of research being done.

6.4 Evaluation of Knowledge Inputs to Regulation

75. Congress sought to expand the application of peer review to the knowledge inputs to regulatory policy making. Bills introduced in the 106th Congress (1999-2000) include: S. 746, to peer review cost-benefit and risk analyses of major rules, among other purposes; H.R. 574, to peer review all regulations supported by scientific data; and H.R. 2639, to peer review the data used in standards promulgated by the Occupational Safety and Health Administration. Many federal agencies, however, already practice forms of peer review in their regulatory, evaluative, or assessment missions. The General Services Administration reports that approximately 25% of all federal advisory committees are "scientific/technical" in nature (excluding grant review committees); this percentage has held roughly constant since GSA began the categorization for fiscal year 1985. Some of these mechanisms, such as the Science Advisory Board of the Environmental Protection Agency (EPA), are decades old. Others, such as the Board of Scientific Counselors of the National Toxicology Program (NTP), are recent innovations.

76. EPA has made the most intensive effort to expand the application of peer review to the use of science in its own decision making. A set of documents published have:

i. Emphasized the importance of external peer review for EPA scientific and technical products, contact between EPA and external scientists, and the use of the best science in decisions-thus setting the agenda for regulatory peer review.
ii. Attempted to set standard operating procedures among various EPA divisions by creating a Science Policy Council (SPC) to "expand and improve peer review in all EPA offices".

iii. Articulated the new policy for "peer review and peer involvement" in EPA that anticipated the peer review of "major work products that are primarily scientific and technical in nature and may contribute to the basis for policy or regulatory decisions.

iv. Primed EPA staff and managers on the "organization and conduct of peer review," (EPA 1998), including specific criteria of when to apply and not apply it.

77. NTP is an agency of the Department of Health and Human Services, created in 1978 with the mission to "evaluate agents of public health concern by developing and applying the tools of modern toxicology and molecular biology. It uses a Board of Scientific Counselors (BSC) to provide peer review for a number of agency activities, including oversight of research conducted in NTP centers and review of nominations for substances to be included in the congressionally mandated *Report on Carcinogens.* In this latter role, BSC demonstrates another aspect of the expanding jurisdiction of peer review: the requirement that all information considered in the decision to list (or delist) a substance in the *report on Carcinogens* be from the publicly available, peer reviewed literature. Further research intends to document the extent to which other federal agencies apply such a stricture in their regulatory, evaluative, or assessment missions.

6.5 Peer review in State Policy

78. There is no systematic information about the use of peer review in the states, but adhoc information suggests that it is talking root and expanding there, too, in both roles of allocating funding and evaluating knowledge inputs. State agencies support modest amounts of research closely related to missions in for example, environmental protection, health and human services, or housing, planning and development. They also support R & D programs aimed specifically at economic development.

79. Many state agencies provide small grants and contracts to academic and other researchers in pursuit of their missions. The New Jersey Department of Environmental Protection, for example, is one of the few such departments in the nation with a separate and highly professionalized Division of Science, Research, and Technology (DSRT). For its extramural research, DSRT conducts a peer review using three reviewers, two of

whom are outside DSRT. The reasons for not using external review include the problem of competitors for the funding reviewing proposals and the problem of quicker turnaround needed by the agency than external reviewers normally provide. The State Science and Technology Institute (SSTI) is a clearinghouse for information about R & D at the state level.

80. There is no systematic information about the use of peer review in state regulatory decisions, although there is evidence of interest among the states in science in policy. California has implemented this interest the furthest. In 1997, Governor Pete Wilson signed SB 1320, which contained a peer review mandate. Also in 1997, a Risk Assessment Advisory Committee issued a final report that asked for peer review to be applied more consistently throughout the state's Environmental Protection Agency (Cal/EPA). Cal/EPA (1998) has begun to implement the request in its strategic planning and the publication of policy and principles for peer review. California's Proposition 65 also mandates a peer function to list chemicals shown to cause cancer, birth defects, or reproductive harm. There are likely a wide array of use of peer advisory committees in support of policy or regulatory decision making in other states.

6.6 Concluding Remarks

81. A review of the use of peer review by the U.S. Federal government suggests that its role and jurisdiction has continued to expand. Not only is a greater share of federally funded R & D (and national R&D) peer reviewed than in the past, but peer review is taking hold as a means of evaluating larger aspects of the R&D system and of producing "relevant and reliable" Knowledge in the regulatory process, in the Federal court system, and even in R&D funding and regulation by states.

82. The expansion of peer review in this manner is not, however, easy to evaluate. Functions of peer review beyond the allocation of funds are based on an analogy to the success of peer review there; yet many criticisms of funding peer review exist, and the analogy between it and regulatory peer review is not exact. Moreover, despite the attempts of many in Congress to quell controversy in regulatory science by adding peer review, the addition of peer review in funding programs does not seem to serve the same purpose, as several of the new peer reviewed funding programs remain politically vulnerable.

83. The increased instance of peer review is reason enough for increased scholarly attention: Can we further quantify and qualify the ways in which the Federal government invokes peer review? Can we specify more completely what political and policy problems are supposed to be resolved by peer review? Can we understand in both a more comprehensive and more detailed fashion the relationship between the processes of peer review and the supposed outputs of relevance, reliability, quality, and consensus? The answers to these questions may lead to a more complete and nuanced understanding of the relationship between politics and science.

B7-PEER REVIEW PROGRAMS IN A TRANSPARENT ENVIRONMENT (USA)

7.1 Introduction

84. In May 2005 American Institute of Certified Public Accountants (AICPA) board of Directors established task force to recommend changes to the profession's peer review programs that would advance the Board's and the AICPA Council's desire for greater transparency of peer review results. The Board agreed that the task force should keep in mind enhancements made to the peer review programs that took effect in 2004 and 2005, as well as the clear movement in the market place and regulatory environment toward greater transparency. The Task Force was chaired by a member of the AICPA Board of Directors and included representation from small, medium and large CPA firms, business & industry, those involved with peer review, some that weren't, state CPA society leadership and regulators.

85. In evaluating the peer review programs and in making its recommendations, the Task Force was specifically asked to review the results of an on-line poll conducted as a part of the Institute's peer review transparency member awareness initiative. The primary purpose of the poll was to assess members' desire to provide greater transparency of peer review results. The Task Force addressed its charge by categorizing into common themes both the comments from the on-line poll and the areas of focus described in its charge. In addressing member input and making specific recommendations, the Task Force also considered the appropriateness of the current peer review model in an era of greater transparency of peer review results.

7.2 Background

86. In 1988 AICPA members voted to make peer review mandatory, but to keep the results confidential. Since then, there has been a steady march toward lifting that veil of confidentiality and making peer review results public. Thousands of AICPA firms currently place the results of their peer reviews in a public file as an enrollment requirement in the Center for Public Company Audit Firms Peer Review Program or as a membership requirement of AICPA audit quality centers and the Private Companies Practice Section.

In addition, thousands of firms notify the public of the results of their peer review due to governmental or regulatory requirements. Many firms take pride in the results of their peer review and use as a marketing tool. This all contributes to the high public expectations of peer review. Demand for access to the results of peer reviews is at an all time high. Based on the changing business and regulatory environment, the AICPA's governing Council passed a resolution in May 2004 that supports the need for increased transparency of the AICPA Peer Review Program and directed the AICPA Peer Review Board and the staff to assist members in meeting their peer review licensing and reporting obligations. The Council also directed the AICPA staff to launch an education and member feedback effort to describe the regulatory and market environment and to gauge member support for the concept of greater transparency and certain mechanisms for achieving it. There are clearly varying opinions among members on the specific decisions and actions involved in moving toward greater transparency.

87. In view of above the Task Force discussed whether making the results of peer review available to a wider audience deserves the continued support of the AICPA. It concluded that greater transparency is absolutely the right direction for the profession, but recognized that in order to gain the support of a majority of AICPA members the Institute needs to address member concerns about the peer review process. For that reason, in this report the Task Force is recommending supplemental enhancements and revisions to peer review, as well as additional actions the AICPA should take, such as an expanded peer review communication strategy. The Task Force believes that greater transparency of peer review results is a demonstration of a CPA firm's commitment to hold itself to high standards and will increase the public's confidence in the CPA profession's core values of competence, integrity and objectivity.

88. The Task Force views its work as part of a continual review and improvement process by the AICPA to ensure that the peer review programs meet their objectives. The PRB (Peer Review Board) remains committed to designing, implementing and maintaining a preeminent peer review program that monitors the quality of a firm's accounting and auditing practice. In October 2003, the AICPA Peer Review Board approved revisions to the AICPA Standards for Performing and Reporting on Peer Reviews. With these revisions the PRB completed a project of reevaluating the administration, performance, report objectives and overall effectiveness of system

reviews as well as engagement and report reviews. The revised standards became effective for peer reviews commencing on or after January 1, 2005. The revisions include, among other items, changes to the reporting model, an enhanced risk-based approach for system reviews, and changes to the type and timing of engagement selection. Along with the issuance of the revised standards, the PRB also published a White Paper which provides background and other pertinent information about the comments received by the PRB from respondents to the exposure draft of the proposed revisions, explains the consideration given to those comments by the PRB, and describes the rationale behind the PRB's adoption of the various provisions in the final standards.

7.3 Current Peer Review Model-Its Appropriateness

89. Issues to be addressed in the current peer review model have been primarily remedial and educational since its inception, appropriate for the current environment where a broader range of users, including regulators, place greater reliance on peer review reports? Are there changes to the model that are needed to satisfy the needs of those users? Some members have expressed concern that increasing transparency would move the peer review process more toward a disciplinary and regulatory function.

90. The Task Force concluded that the current peer review model is appropriate, but its effectiveness could be significantly enhanced through the recommendations in this report, particularly those that seek to achieve greater transparency. The Task Force recommends that state boards of accountancy be encouraged to require peer review as a condition of licensure for any members in public practice subject to peer review. It also suggests that state boards of accountancy explore their options to expand access to the peer review results of its licensees. Finally, the Task Force recommends that state boards recognize peer review as one of the tools, although certainly not the sole tool, to regulate the profession.

91. The Task Force recognizes that when peer review was created, it was intended to be a remedial and educational process to assist members and improve the quality of their accounting and auditing practices. It was not created to assist state boards of accountancy and other governmental entities with their regulatory responsibilities. Over time, as regulators and others have come to rely more on peer review, the peer review

process has been enhanced to address the needs of these users as well. In recognition of the current regulatory environment and the needs of the various users of peer review, the AICPA Peer Review Board recently revised the peer review standards, effective January 1, 2005. Members, however, may not be aware of these recent enhancements to the peer review process, particularly those that address regulatory concerns. With these changes in mind, the Task Force determined that the current peer review model is appropriate and can be an effective tool, if used in connection with other regulatory tools, to assist regulators in the regulation of the profession. While the Task Force believes the current peer review model is of high quality, it believes the recommendations will further enhance the process for all users, including regulators.

92. The Task Force believes that peer review is an outstanding tool, not only for the reviewed firms to improve their practices and users of CPA services to make decisions on who to hire, but also for governmental entities and regulators. The Task Force met with representatives from various regulatory bodies who agreed with the philosophy that while peer review contains very useful information for governmental entities to use as a part of their regulatory efforts, it is not intended to supplant their overall regulatory responsibilities. Further, the Task Force believes in a level playing field and recognizes the benefits derived from uniformity of state law governing CPA practice. The Task Force also believes that all state boards of accountancy should focus on expanding their options regarding public access to peer review results. It also believes that state CPA societies should be encouraged to require peer review as a condition of society membership.

93. However, Task Force recognizes the difficulty of having a peer review model that satisfies the needs of all its users. It believes that with the recommendations of the report, a peer review model can satisfy the needs of multiple users of peer review information, including regulators who can continue to use it as an effective tool in their regulatory process.

7.4 Reporting Model of Peer Review

94. Several comments from members in the on-line poll indicated that the current peer review reporting process contains information that is confusing, and in some cases is,

misunderstood or misused, either intentionally or unintentionally, by third parties. Specifically, the use of the terms "unmodified," "modified" and "adverse" may have little meaning to certain users, and the inclusion of the Letter of Comment (LOC) as part of the peer review report complicates the general understanding as to whether a firm's practice is good or needs improvement. These matters need to be addressed in light of the growing mandate that the results of peer reviews be made more widely available. This is especially true when peer review reports filed with state regulators, can be accessed by third parties through "freedom of information act" disclosure requests.

95. The Task force recommends that the Peer Review Board reevaluate the reporting model and consider changes that will enhance the understandability and usability of the reports. Listed below are some directional changes that the PRB should consider:

(i) Revise peer review reports to be as concise as possible.

(ii) Revise the language in the reports to be as simple as possible and in "plain English," including an explanation of what peer review is and is not.

(iii) To the extent possible, design the reporting language, in system, engagement and report reviews to be as consistent in content and form as possible.

(iv) Change the "grading" process from "unmodified," "modified," "adverse," and "significant comments on a report review" to terminology that is more easily understood by the general public and that clearly articulates the quality of a firm's practice.

(v) Since the matters reflected in the LOC do not impact the type of peer review report issued, eliminate the LOC as a part of the current reporting model and communicate those matters to the firm as part of the overall peer review process, similar to how other matters identified in the peer review that don't impact the nature of the peer review report are communicated.

(vi) Maintain the existing peer review report concept whereby the report is a standalone document that discloses the significant matters affecting the type of report issued.

96. In a time of greater transparency, where peer review reports are more widely read by regulators and users of CPA services, the information in the reports must be both understandable and useful. The Task Force believes that recommended changes to the report mitigate concerns that peer review information will be misused or misunderstood

by a broader audience and do not reduce the rigor of peer review. The Task Force believes that in conjunction with other recommendations herein a simpler, easier to understand peer review report will not only reduce member concerns about the misuse of information, but also would provide a more valuable tool for all users of the reports. The Task Force also spent considerable time discussing the role of the LOC in the peer review process. It believes that the Peer Review Board should eliminate the LOC from the peer review reports that are made available to third parties.

97. The Task Force recognizes that the types of issues normally included in an LOC are still very important to communicate to a firm so it may use the information to improve the quality of its accounting and auditing practice. In fact, the information included in a LOC is more relevant to the reviewed firm than to third parties. It is important for the public, including governmental entities and regulators, to have access to understandable peer review results that clearly articulate the quality of the CPA firm's practice. The determination as to whether a modified or adverse report is issued is usually much less subjective and more straightforward than determining the matters to be included in a LOC. The information contained in the report should be sufficient for regulators and others to make informed decisions about CPA firms, and should allow regulators to use this information as part of their overall regulatory strategy. Furthermore, the concern of members related to the misuse of peer review information contained in the LOC should be mitigated by its elimination.

98. Further Task Force feels that simplifying the peer review report will involve several approval processes. Another concern is that many regulators currently have within their standards or rules language references to the LOC that would need revisions. The answer, it is believed, is to enlist support for changes to the report, including the elimination of the LOC, from the governmental entities and regulators, which use peer review as part of their overall regulatory structure. The Task Force discussed whether some may interpret these recommendations as being less transparent, since the matters formerly in the LOC would no longer be a part of the reporting process. But the Task Force concluded that based on the nature of the matters that remain in the report, the users of the peer review report will still have the significant information they need to make informed decisions about reviewed firms.

7.5 Oversight Issues

99. Although members responding to the on-line poll did not directly comment on the oversight process, the Task Force believed that many comments received relating to inconsistencies in the performance among peer reviewers and administering entities are oversight issues. For that reason, the Task Force discussed the following:

(i) The administering entities' oversight over peer reviewers,

(ii) The AICPA's oversight over the administering entities,

(iii) The state boards' of accountancy oversight relationship with administering entities' peer review committees, and

(iv) A potential alternative oversight structure being contemplated by the National Association of State Boards of Accountancy (NASBA).

100. The Task Force urges that the peer review programs continue to recognize and promote the importance of oversight as an integral part of the peer review process, including the current relationship many state CPA society administering entities have with independent state boards of accountancy and their oversight bodies. It suggests, however, that the existing oversight processes be made more transparent by communicating the objectives, procedures, and results of oversight to the public without identifying specific individuals or firms. Specifically it recommends:

(i) The issuance of an annual report by the AICPA Peer Review Board describing its oversight process, the procedures performed with respect to the administering entities and the general results of its oversight for the year.

(ii) The issuance of an annual report by each state CPA society administering entity describing its oversight process, the procedures performed with respect to the reviewed firms and peer reviewers, and the general results of its oversight for the year. This report should include other useful information, such as breaking down the oversight results by such factors as size of firm, the number and types of reviews conducted, as well as a summary of the substandard engagements and actions required to be taken by reviewed firms.

(iii) Reports on the results of the AICPA Peer Review Board state CPA society administering entity oversight visits.

101. AICPA Peer Review Board recognizes that the current oversight process is critical to the continued success of the Peer Review Program and supports independent state board of accountancy oversight. The primary objective of oversight is to provide a level of assurance that peer reviews are being performed and reported on by qualified independent individuals and administered in accordance with the *Standards for Performing and Reporting on Peer Reviews* and other guidance from the Peer Review Board. Another key objective is to ensure the consistency of reviews in all states and by all reviewers. The Task Force discussed the nature and extent of the peer review programs' oversight processes in detail, and believed that a general description of that process in this report was warranted. It believes that communicating such a description to users and potential users of peer review results would mitigate many of the concerns related to the potential inconsistencies between different reviewers and in the quality of reviews.

102. The AICPA Peer Review Program is administered by 41 state CPA societies (administering entities). Each one is required to have its own written policies and procedures for oversight over peer reviews and peer reviewers that adhere to the guidelines established by the AICPA Peer Review Board. The administering entity's oversight process is, in turn, "over sighted" by the AICPA Peer Review Board. Members of the AICPA Peer Review Board or AICPA staff visit each of the administering entities at least once every other year. Annually, samples of reviews are subject to oversight by AICPA peer review staff. Several administering entities have also entered into an oversight relationship with a state board of accountancy whereby the state board appoints a body to oversee its administration of the AICPA Peer Review Program. The objective is for the oversight body to determine whether the administering entity is complying with the peer review standards and guidance such that the state board of accountancy can rely on the AICPA Peer Review Program to meet its peer review licensing requirements.

103. The Task Force also discussed NASBA's current initiative, the consideration of an independent national oversight body, possibly similar to its Examination Review Board. The Task Force questioned whether an independent national body would be more appropriate than one at the state level that would likely be more familiar with state laws and regulations. After all, many state boards of accountancy have indicated that their current oversight process is already working well. They are accustomed to writing their own laws and rules, and most state legislatures may not want to turn over oversight responsibility to a national body. The concept was discussed that a national oversight body could develop best practices for individual state boards of accountancy to consider and to assist state boards that do not have an oversight body. However, the Task Force concluded that the current model, where individual state boards are independently assessing how the AICPA Peer Review Program is being administered, is working well. There was limited support amongst the Task Force members for the concept of a single independent national oversight body without having a formal model, including its implementation plan, to assess.

104. Some users of peer review results believe that peer review is intended to find every deficiency a firm might have, and that every peer review will be performed, reported on and accepted exactly the same way. Neither of these expectations is realistic. Peer review was never intended to detect every deficiency a firm might have. Furthermore, there are more than 1,700 peer reviewers, 600 administering entity peer review committee members, and 10,000 peer reviews performed annually. While every peer review could not possibly be the same because they all include a level of professional judgment and subjectivity, the Task Force feels that the strong and transparent oversight process helps ensure that reviews are being performed, reported on, and accepted consistently and in accordance with the standards.

7.6 Strategy for Communication and Education

105. If the results of peer review are to be made available to the public, users and potential users of that information must not only be able to understand the information, but the process behind it.

106. The Task Force recommends that the AICPA continue its peer review communication strategy with members and begin to develop a long-term communication and education strategy targeting the users of peer review reporting, including consumers of CPA services and regulators. The member communication strategy should be focused on describing the details of the peer review program in a way that enhances the understanding of the program and its features among members. The user communication strategy should explain the objectives of peer review, what it is and isn't, how the process works, what the reporting means, and the importance of oversight.

107. It is apparent that there are many members, as well as other key users and potential users of peer review results, who are not fully aware of the comprehensive nature of peer review, its benefits, its limitations, and the advantages of making the results of peer review available to the public. A successful effort to enhance understanding of the peer review process will have several beneficial effects. State and federal regulators will better understand the benefits and limitations of peer review, and will be better able to focus their regulatory efforts to achieve maximum efficiency and effectiveness of their overall regulatory programs. AICPA members in business and industry and others in management can use the results of a firm's peer review as a part of their due diligence when hiring an accountant or auditor. This could significantly drive future behaviour and make the public appreciate the value of the peer review process. By enhancing value, this could also in turn attract more qualified reviewers.

108. Communicating to many different users and potential users of peer review information is a complicated endeavor that may require extensive financial and human resources. A communication strategy of this magnitude is also not a short-term project. However, the Task Force believes it is a vital part of the successful implementation of the recommendations by the Task Force, the move toward greater transparency, and the effectiveness of the regulation of the profession.

7.7 Greater Transparency

109. The CPA profession has been engaged in a healthy discussion regarding mechanisms for increasing the transparency of peer review reports. Given the current

environment, in which regulators and other users are demanding more access to peer review results while members remain divided on the appropriateness of greater peer review transparency, is there a way that users can get what they need while at the same time addressing the concerns of some members.

110. Task Force believes that all firms subject to the AICPA Peer Review Program should make the results of their peer review information more transparent. It recommends that, at a minimum, the peer review reports of firms which have received a second consecutive modified or any adverse peer review should be made public. To facilitate this, the PRB should change the process to require administering entities to notify state boards when any firm receives a second consecutive modified or any adverse peer review report, and to provide the appropriate state board of accountancy with access to that information.

111. Acknowledging that the percentage of firms that will have consecutive modified or adverse reports is low (currently less than 5%), it is nevertheless in the public's interest to make the results of these firms' peer reviews available to state regulators for use in regulating the profession. With the elimination of the LOC, the information posted would likely consist of the peer review report issued by the reviewer, the letter of response by the reviewed firm if applicable, the acceptance letter from the administering entity, and the firm's agreement to take any follow-up or corrective action related to matters contained in the report as a condition of acceptance if applicable. Also, where applicable, included would be the letter from the peer review administering entity informing the firm that the follow-up or corrective action has been completed to the satisfaction of the peer review committee. Several state boards of accountancy already require licensees to submit these documents to them, so for many firms this would not be a change.

112. The Task Force also considered the concerns of members that greater transparency would make it easier for peer review information to be used for litigious purposes. However, AICPA has found no instances in the 25 when the courts have looked to the information in the public file without going directly to the reviewed firm. While the Task Force recognizes that past experience does not necessarily predict future

behavior, there is also no indication that there has ever been a claim filed against any member based on a peer review outcome. Lastly, some members communicated concerns that greater transparency of the results of peer review will be used in a negative way to solicit clients. The AICPA Code of Conduct does not permit a member to use peer review or any other firm information in a false or misleading manner.

113. The Task Force is, however, concerned that motivating members to participate in a voluntary public file in states with no peer review or submission requirement would be a challenge. More importantly, the Task Force understands that the process of removing confidentiality via a membership ballot process will be an expensive and time-consuming endeavor.

7.8 Decline in Quality Peer Reviewers

114. Evidence suggests that there is a declining and an aging population of qualified peer reviewers in the AICPA Peer Review Program.

115. The Task Force recommends that the AICPA conduct a comprehensive peer reviewer recruitment campaign to attract new, quality peer reviewers and to educate firms on the benefits of having their owners and staff members involved in performing peer reviews. The recruiting strategy should address the low fees typically charged by reviewers. The task force believes these low fees are a significant contributor to the decline in the numbers of reviewers. The educational campaign should also aim to raise the level of professional respect for reviewers, focusing on the high quality of their work and the requirements that reviewers must meet in order to perform reviews.

116. The declining number of qualified peer reviewers, and younger reviewers in particular, suggests that in the near future there will be an inadequate number of qualified reviewers to sustain the number of peer reviews performed on an annual basis, unless those reviewers perform more reviews. This will also translate to a shortage in the number of qualified members who serve on state CPA society peer review committees.

7.9 Inconsistency in Peer Performance

117. Some of the concerns expressed by members related to the performance of reviewers and their qualifications, as well as inconsistencies in the performance among peer reviewers.

118. Given member perceptions about the quality of peer reviewers, the Task Force recommended that the Peer Review Board continue to ensure that the quality of peer reviewers remains high. The Task Force believes that the PRB should consider establishing additional minimum requirements to be a peer reviewer such as, requiring a minimum number of annual accounting and auditing hours spent by a reviewer in his or her own firm. The PRB needs to be flexible in measuring those hours, and needs to consider hours spent as an engagement partner, or performing concurring reviews and quality control functions in the firm for example. The PRB should also continue to issue standards and guidance promoting the training of reviewers, and oversight of that process. The PRB's efforts should be widely publicized as one step towards improving member perceptions about reviewer quality.

119. The Task Force recognizes that consistent, high-quality peer reviewer performance is a critical element to the success of the peer review process. The Task Force believes that enhancements issued by the AICPA Peer Review Board, along with its recommendations, satisfactorily address concerns related to peer reviewer performance and qualifications. Accordingly, the Task Force believes that no other changes are necessary specific to the peer reviewer qualification requirements, except for the minimum accounting and auditing hours requirement. Some members of the profession have also made this argument and that reviewers should be required to spend a minimum number of accounting/auditing hours in their own practices as a requirement to be a peer reviewer.

120. It is the responsibility of the technical reviewers and the peer review committees to ensure that peer reviewers apply professional standards appropriately and are not "setting" professional standards by requiring a reviewed firm to apply procedures beyond that of professional standards, including quality control standards, or the firm's own

policies and procedures when these exceed professional standards, and that the work they perform supports the peer review report and other documents completed by the reviewer. In some cases, reviewers are issued feedback by the administering entity's peer review committee on their performance with corrective measures to improve performance. Depending on the significance and pervasiveness of the problem, a reviewer may be restricted from performing peer reviews. In this case, the restriction is communicated to all administering entities for consideration as part of their own peer review administration and oversight.

7.10 Services in Scope Practice

121. Some members raised the question of whether to expand or reduce the current services covered by the peer review process. Currently, engagements performed under the Statements on Auditing Standards, Government Auditing Standards, Statements on Standards for Accounting and Review Services (SSARS), and Statements on Standards for Attestation Engagements (SSAEs) are included in the scope of peer review. The Task Force recommends no revisions to services in the scope of practice included in the peer review process.

122. The Task Force discussed whether a firm could benefit from having other aspects of its practice peer reviewed and whether there was a compelling public interest to do so. The Task Force agreed that all services performed by a CPA firm are important, and anything peer review could do to improve the quality of practice would always be in the public interest. However, the Task Force discussed the fact that there is a difference between a firm's practice as it relates to services performed that offer some level of implied or actual assurance versus those that do not. The Task Force agreed that both are very important, but believes that the focus of peer review should remain on the aspects of a practice for which assurance is provided (either actual or implied). The Task Force also discussed:

(i) The lack of measurable professional standards for other areas of practice (tax, management consulting services and litigation support, for example).

(ii) That in most cases one didn't need to be a CPA to perform non accounting and auditing services, and subjecting a firm to peer review for other services would put CPA firms at a competitive disadvantage.

(iii) Given the diversity and specialization of firms and practices, it would be a monumental task to review other aspects of a practice beyond attest and compilation services.

(iv) There appears to be no outcry from the public or state and federal regulators for peer review to cover other aspects of a firm's practice. Many of these areas are regulated in some other fashion.

7.11 Practice during Peer Review

123. On the issue of whether process for selecting the types and number of engagements on a peer review currently appropriate the Task Force recommends that no revisions be made to the coverage of practice during the peer review. However, the Task Force does suggest that additional risk assessment guidance be issued to peer reviewers performing reviews of firms with multi-office and multi-state practices.

124. The Task Force focused its discussions on CPA firms with auditing practices. The standards discuss in detail the peer reviewer's risk assessment and the link to engagement selection. On a system review, the peer reviewer gains an understanding of the firm's office operations, in addition to many other aspects of the firm's practice, in order to determine which offices, partners and engagement to cover using a risk-based approach. In addition to covering a reasonable cross-section of the firm's practice, when applicable, all peer reviewers must also select at least one engagement subject to ERISA, one engagement subject to Government Auditing Standards, and one engagement subject to the Federal Deposit Insurance Corporation Improvement Act (FDICIA). The reviewer must also be able to adapt the coverage of practice based on what is found during the peer review. In this way reviewers use a risk-based approach, while also obtaining a reasonable cross-section of the firm's entire practice rather than focusing solely on a single criteria or percentage coverage of specific industries. The Task Force also discussed multi-state practices, with an eye toward satisfying state

boards of accountancy that a firm's practice in its state is appropriately covered during the peer review when it is administered in a different state.

125. The peer review process for firms performing audits results in a report that opines on the firm's system of quality control in its entirety. There will always be some who may believe more engagements in their area of interest should be selected or that a peer review should automatically cover a certain percentage of all engagements. The Task Force understands these issues and considered them during its discussions of whether peer review should be a regulatory model. The Task Force has concluded that the risk-based model that considers a reasonable cross section of the firm's practice during the peer review is appropriate.

7.12 Task Force Recommendations (Summary)

126. **Create a new reporting model-** The Peer Review Board should reevaluate the reporting model, and consider changes that will enhance the understandability and usability of the reports.

127. **Enhance annual reporting on oversight-** The following reports should be published and their existence widely promoted:

- An annual report issued by the Peer Review Board (PRB) on its oversight of all administering entities.

- An annual report issued by each administering entity on its oversight of its peer review process, including peer reviewers.

- The individual reports issued by the PRB on each PRB oversight visit of the administering entities.

128. **Continue and enhance communications to members and external parties-** The Task Force recommends that the AICPA continue its peer review communication strategy with members and begin to develop a long-term communication and education

strategy aimed at the users of peer review reporting, including consumers of CPA services and regulators.

129. **Provide for greater transparency of peer review reports-** The Peer Review Board should require administering entities to notify state boards when a firm receives a second consecutive modified or any adverse report. Moreover, the administering entities should place these peer review results in a state board access file – regardless of state requirements.

130. **Create a level playing field for those subject to peer review-** The Task Force recommends that all state boards of accountancy should require peer review as a condition of licensure. The Task Force also recommends that all state societies be encouraged to require peer review as a condition of membership.

131. **Expand the voluntary public file for all peer reviewed firms-** The AICPA should provide a mechanism for members to comply with state board licensing requirements by allowing any AICPA firm to post its peer review results in the AICPA's current public file regardless of membership in a specific AICPA section or audit quality center.

132. **Create a program to increase the pool of peer reviewers-** The AICPA should conduct a comprehensive recruitment campaign to attract quality peer reviewers. This will include educating firms on the benefits of having their partners and staff members involved in performing peer reviews.

133. **Ensure the quality of peer reviewers-** The Peer Review Board should continue its efforts to ensure the quality of the peer reviewers and consider additional minimum criteria to be a peer reviewer such as, but not limited to, requiring a minimum number of accounting and auditing hours spent by a reviewer in his or her own firm.

7.13 Conclusion

134. The Task Force believes that by implementing the recommendations in this report, peer review can appropriately serve the needs of users of peer review information in a transparent environment. The Task Force recognizes that some recommendations within this report are simple and can be implemented quickly, while others are not so easily implemented and may be costly. It also understands that many of the recommendations are dependent on each other for their success The Task Force supports the principle of greater transparency in the reporting of peer review results and believes these recommendations can further the effort to encourage more members to join in that support.

C – S&T AUDIT AND PR OF AUDITORS

C-S&T AUDIT AND PR OF AUDITORS

1.1 Science/Technology Audit Enhances Transparency

1. Science Audit can promote transparency and consequently accountability in R&D Sector. Since funding is reported to be exponentially Increasing in Science Departments such audit is gaining significance for the sake of transparency in funding as well as in peer review. Third party review i.e. peer review from outside the scientific community is necessary to reassure the common man of the right use of tax paid by him. It is also important to ensure that science projects do not suffer for want of funds and also these are channalised to make best use of available money.

2. It is felt by experts that Science Audit should also be through Audit Board mechanism, If there is an Audit Board with specialists on top, Audit opinion is likely to become more valid. Audit should also distinguish between Core Science, Applied Science, R&D Projects and Technology commercialisation etc.

3. Experts opine that following reforms when practiced, do contribute towards greater transparency in funding and review;

(i) Simplify the rules and regulations so that scope of corruption is reduced;

(ii) Transparency and empowerment of public. Right to Information Act is very welcome step in this direction and also the increasing use of computerization is a measure to ensure that people have access to information.

(iii) Reasons for specific judgement must be recorded in real time. This is very important as many a times, the scientific audit catches people and the scientist comes to grief because he failed to record,

4. Technology audit is an integral component of technology strategy formulation process. A systematic process of 'Technology Audit' is of paramount importance to assess the technological capabilities of the organizations. The audit accommodates the needs of individual manufacturing organization and emphasizes the importance of appropriate technology and systems. Technological audit would allow the organization to

make the optimum use of its available technological capabilities. The focus of technology audit is on core competencies of a technological unit. Technology Audit is vital stage in developing a strategic plan for technology management.

5. Objectives of the technology audit can be summarised as under:

(i) To identify and evaluate the technological resources and capabilities of the organization.

(ii) To assess and evaluate the market significance or potential of the organization's technologies.

(iii) To assess the competitive position of the organization in it's technologies.

(iv) To understand and identify how the organization can develop and exploit it's technologies in order to build and maintain sustainable competitive advantages.

(v) To develop a base upon which technology strategy and associated plans can be formed.

(vi) To identify the opportunities for improvement.

6. Technology Auditing calls for participation of both top management and staff related to technology. Selection of the auditing team is an important phase. Team size may vary depending upon the scope of audit. Though there is no formal education or qualification required to be a member of technology audit team, following guidelines can be useful.

(i) Knowledge and understanding of technology management.

(ii) Understanding and experience at strategic level in business.

(iii) An aptitude for data analysis.

1.2 Audit of Science, Engineering and Technology Skills

7. Departments of Education, Science and Training Australia had brought out a discussion paper in 2005 on the above subject. Information that is given below is extract from the said paper.

8. Australia's future prosperity relies heavily on Science, research and innovation and its ability to perform successfully in a highly competitive global market. Australia has a substantial science, engineering and technology capacity- Australia's Gross Domestic Expenditure on research and Development (GERD) doubled between 1986-87 and 2003, reaching $ 12.2 billion in 2003, when GERD was 1.6 per cent of Australia's Gross Domestic Product (GDP). Need is thus felt for an audit of Science, Engineering and Technology (SET) skills.

9. The terms of reference for the audit were approved by the Minister for Education, Science and Training in February 2005 following consultations with representatives from the learned academies, the science research community and industry about key issues to be addressed through the audit. The audit will focus on the extent to which Australia's current and future industry and research body needs are being met by the higher education and VET (Vocational Educational Training) sector in the supply of SET graduates. In particular, it will provide an understanding of where shortages lie.

10. The audit will consider the supply of and demand for science skills across a broad range of SET disciplines and conduct case studies of specific industries.

11. The audit will be overseen by a high level Steering Committee comprising representatives from industry bodies, the science community, university sector, learned academies and VET sector. The audit will include high level analysis of existing data and may also involve the collection and analysis of new data. The audit will involve extensive consultation with a broad range of stakeholders.

12. The key issues that will be addressed through the audit will be further refined through discussions with the Steering Committee and other interested parties. Major

questions for consideration through the audit revolve around the topics of (i) demand for SET skills, (ii) Supply of SET skills. (iii) Improvement of VET system, (iv) higher education and (v) question of migration of skills

13. The Australian Bureau of Statistics Australian Standard Research Classification is "the collective name given to a set of three related classifications developed for use in the measurement and analysis of research and experimental development (R&D) undertaken in Australia, both in the public and private sectors." The Field of Research (FOR), the second element of the classification, categories R&D activity by academic discipline. Under this classification the following SET fields apply

- Science — general;
- Mathematical Sciences;
- Physical Sciences;
- Chemical Sciences;
- Earth Sciences;
- Biological Sciences;
- Information, Computing and Communication Sciences;
- Engineering and Technology; and
- Agricultural, Veterinary and Environmental Sciences.

14. Given the need to limit the scope of the audit to a realistic size, it is proposed that the audit use the fields of research listed above to define the scope of the audit, subject to discussions with interested parties.

1.3 Peer Review of Auditors

15. Sebi (Securities & Exchange Board of India) in conjunction with ICAI (Institute of Chartered Accountants of India) is all set to usher in a welcome change for strengthening the auditing process to be followed by all listed companies. Sebi is likely to amend the listing agreement to stipulate that audit firms who hold a peer review certificate will only be eligible to conduct audits of listed companies. In the meantime, the government has already constituted a Quality Review Board (QRB) under the Charted Accountants Act, 1949. These steps will be very positive for improving the quality of audit in case out listed companies and providing greater comfort to small investors and general public.

16. Auditors of listed companies, pursuant to this upcoming change, will now have to be prepared for a rigorous review by independent fellow professionals. This will lead to strengthening of the audit process and methodology deployed, including documentation of work papers and basis for arriving at conclusions on critical matters. This in turn will ensure that these engagements are appropriately staffed with audit professionals having the necessary skills and expertise.

17. This is definitely an encouraging step towards improved and credible auditing of listed companies. That said, this measure alone may not have the desired benefit and more would need to be considered.

18. To start with the process of peer review will largely depend on the quality of the reviewers. The selection process followed by ICAI for empanelment of the peer reviewers will have to be quite robust and these reviewers should have experience of auditing large companies.

19. This process is a recent initiative of ICAI and a large number of audit firms are yet to be covered under peer review. The matter of fact is that it is early to comment on the efficacy of this process and what effectively comes out of it.

20. Sebi will also have to reach an arrangement with the ICAI whereby the results of such quality/peer review will be shared with Sebi, which may be desirable from a transparency and risk management standpoint. The Ministry of Corporate Affairs, Sebi

and Institute must come to an agreement and have agency for monitoring quality in the audit profession and not set up multiple agencies for the same function.

21. The quality review must specifically focus on unadjusted audit observations and key matters where exercise of judgement was involved by the auditors. It must also cover how these matters were shared with the audit committee. These will foster greater accountability on corporate management, the independent directors as well as auditors.

22. The quality of the audit will depend on the quality of the auditor and his relative strengths. A peer review will only be a post modem review, hence it may be better to adopt prevention rather than cure.

23. An imperative step in this direction would be on the part of ICAI to ensure that students pursuing the CA course get the right amount of practical training. In order to perform a quality audit, apart from technical knowledge, it is very critical to general management skills besides a deep insight into functioning of large corporate businesses.

24. Audit professionals need to tone their inter-personal and conviction skills to be able to effectively manage the challenge associated with audits of listed companies and dealings with audit committee and board members. These skills can on be acquired through diligent practical work experience in similar challenging environments.

25. Clearly, business failures may happen and no regulation can prevent that. However, misappropriation of public money, misstatement of facts and financial results can be avoided with focus on ethical governance and strong auditor's fraternity. The independence and objectivity of auditors is the key issue, which still remains a matter of personal belief and prerogative. Auditors need to play their role as watchdogs effectively.

26. Although appointed by the acting promoter management group, their reporting responsibility is towards the public in general particularly in context of listed companies. The auditor's role is becoming difficult and challenging, but they will need to live up to these expectations, hopefully with the right kind of legislative support from government bodies.

(Above are personal views of Director, Ernst & Young India).

D – PRACTICES IN INDIA

(D1-D2)

D1-OVERVIEW OF EXISTING PRACTICES IN INDIA

1. Attempt has beet, made to collect the latest data and procedures followed by leading Funding Agencies in the Country on topic of peer review arid its transparency. A simple questionnaire proposed on the subject was forwarded to various Central Government departments and agencies to elicit required information for further appropriate analysis. Though response has not been as expected, information was also collected from the published literature on the subject Department/Agency wise and also form the participants of the Interactive Meet in September, 2008. These are brought out, in brief as under with specific reference to mechanism of Funding and Transparency etc. and also the comparative study of responses to Questionnaire.

1.1 All India Council for Technical Education (AICTE)

2. The AICTE was established by an Act of Parliament in the year 1987 with a view to promote proper planning and co-ordinate development of technical education system throughout tie country.

3. After an initial scrutiny at the Bureau level, proposals are screened by expert on the subject, and if recommended, the concerned Principal Investigator / Coordinator of the Project is invited for presentation of the project proposal before an Expert Committee. Projects recommended by the Expert Committee are placed before the Board of Research of Institutional Development With a view to ensure effective implementation of these schemes, AICTE has set-up an Advisory Board, namely Board of Research & Institutional Development comprising of eminent scientists, engineers, technologists, academicians and industrialists.

1.2 Council of Scientific and industrial Research (CSIR)

4. The major functions of CSIR include promotion guidance and coordination of scientific and industrial research in India; establishment or development of and assistance to existing special institutions or departments for scientific study of problems affecting particular industries and trades: award of fellowship: utilization of Council's R&D

5. The Human Resource Development (HRD) Group of Council of Scientific & industrial Research (CSIR) has a mandate to develop and nurture S&T manpower at the national level it also promotes, guides arid co-ordinates scientific & industrial research through research grants to Scientists/Professors working in Universities Institutes of Higher learning.

6. The Governing Body of CSIR is the Apex Body to consider the research proposals. The proposals received by CSIR are sent to a number of referees and the concerned CSIR laboratories for evaluation and comments. These are further evaluated by the respective research committees. A number of discipline wise research committees have been constituted by CSIR for this purpose. The research committees submit the proposals with its recommendation to the Governing Body for taking a final decision on the project. The research committees usually meet twice in a year.

7. The PI is required to submit annually comprehensive report on prescribed proforma for renewal of the project to next year. These reports are evaluated by the respective Research Committees. Projects are also monitored through presentation by PI in monitoring sessions.

1.3 Defence Research and development Organisation (DRDO)

8. DRDO is dedicatedly engaged, in the formulation and execution of programmes of scientific research, design and development, testing and evaluation leading to induction of state-of-art weapons and equipment which would compete and compare favorably with its contemporary systems available elsewhere in the world. It consists of a chain of laboratories/establishments situated all over the country, pursuing assigned scientific goals with delegated powers under the policy direction provided by the headquarters in New Delhi. DRDO also supports a substantial amount of extramural research in academic institutions and other laboratories on defense related problems through various grants-in-aid schemes and other sponsored projects. Truly indigenous solutions to military problems and the related technologies can be developed only if judicious investments are made in expanding and deepening the foundations of basic scientific knowledge and the technological validation of new concepts that emerge from such

knowledge. Such enlargement of the applicable knowledge base is accomplished by the exertions of, and the imagination released in, young researchers and their mentors in academic institutions.

9. The proposals are referred to the appropriate specialists of DRDO laboratories and senior professors from academic institutions. Based on the recommendations of the experts, the proposals are put up to Director Er & IPR or Chief Controller (R&D). The Director Er & IPR issues the sanction letter for the approved proposals. The Institution/organization s required to submit 4 copies of the annual progress report of the projects in the prescribed proforma for the Director Er & IPR and other lab experts. The decision to continue the project is taken based on the outcome of the project review meeting.

1.4 Department of Atomic Energy (DAE)

10. The Department of Atomic Energy supports research programmes in Nuclear Science and Technology through the Board of Research in Nuclear Science (BRNS).

11. The research proposals are referred to the concerned Advisory Committee The proposals are thereafter referred to specialists in the field and members of the Advisory Committee. Proposals requiring a large funding, a sub committee consisting of experts in the field is constituted for initial evaluation In such cases, members of the Advisory committee may visit the institution or invite the Investigator to assess the laboratory facilities. The Advisory committees forward their recommendations on each research proposals to BRNS. ORNS makes its recommendations to the DAE. Based on the recommendations of BRNS, new proposals are approved by DAE.

12. For all major projects a monitoring committee is constituted. For Projects not having a principal collaborator from DAE, a coordinator for DAE is nominated. The investigators are required to present their progress of work to the Advisory committee and experts in the field. Five copies of the Project Completion Report (PCR) are required to be submitted to DAE. These are referred and reviewed by the Advisory Committee.

13. In addition to the normal projects submitted by the principal investigators for financial support, BRNS also considers some intensively funded schemes of importance to DAE as well as to create major centers at selected places to develop expertise in a particular area of science and technology. These proposals are funded after critical evaluation and wherever necessary BRNS constitutes separate sub-committees with experts drawn from both within and outside DAE for evaluation and follow-up.

1.5 Department of Ayurveda Yoga & Naturopathy Unani, Siddha and Homoeopathy (AYUSH)

14. The AYUSH Systems include Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homoeopathy and include therapies documented and used in these Systems for the prevention and cure of various disorders and diseases. India has a large infrastructure for teaching and clinical care under these Systems. The scientific validation of the treatment however still remains to be done on a wide scale. The Department of AYUSH has introduced a Scheme for extra-mural research in addition to the intramural research undertaken by four Research Councils for Ayurveda & Siddha, Unani Homeopathy, Yoga & Naturopathy set up by the Ministry of Health & Family Welfare three decades ago. The off take and output from this scheme has so far been limited and has not been able to meet the standards for scientific enquiry and outcome effectively. The Department has taken up a series of programs/interventions wherein evidence based support for the efficacy claims is needed Safety, quality control and consistency of products are also very much required. In the present era of globalization and development of a world market for traditional and herbal medicine, research & development is needed to promote the production and export of quality products in the form of drugs food supplements, toiletries and cosmetics. There is an intense competition from other countries in the trade of herbal products. India share in the world market is negligible. The revised extra-mural research project has, therefore, been designed to encourage R&D in priority areas so that the research findings lead to validation of claims and acceptability of the AYUSH approach and drugs.

15. In indirect route — The brief outline sent by an applicant is discussed by a core group of the Research Advisory Group consisting of clinicians, clinical pharmacologists and a statistician and a protocol with focused research methodology is finalized if the

project concept and outline are found to be relevant and worth pursuing. The investigators and location would be decided and the trials taken up after the protocols are finalized in consultation with the promoters of the project. In this approach, the onus for getting the approval of the Research Advisory Group to be designated in each case will be of the promoter of the research idea. Research Advisory Group for priority areas other than clinical research could also be constituted if any specific proposals are received. As for direct method the Department of AYUSH through the Central Council for Research in Ayurveda & Siddha (CORAS), Central Council for Research in Unani Medicine (CCRUM), Central Council For Research in Yoga & Naturopathy (CCRYN) and Central Council for Research in Homeopathy (CCRH) invites applications with a closing date, from accredited institutions. Projects may also be awarded to eminent scholars and practitioners, who could route their applications through the heads of accredited organizations. The grants will be released to concerned organizations who would be responsible for expenditure and utilization of Funds. The proposals would be scrutinized and screened by experts from a panel maintained by the Department. A committee chaired by the Secretary of the Department of MUSH would then consider the proposals recommended for acceptance by the Technical Screening Committee. The Department may identity suitable investigators as per the requirements of a particular situation and also assigns the projects to them.

16. A Project Evaluation Committee consisting of adviser (Ayurieda/Unarni/Homoeo), Director (CCRAS/CCRUM/CCRYN/CCRH) as the case may be, two subject experts from concerned system of medicine, two representatives of CSIR/ICMR/DST/DBT will evaluate the project allocation. periodically evaluate the work done by the investigators and recommend the grant Third party technical expels shall also monitor the quality of research and implementation of the project by spot visits. Reports on the progress of work done under the research scheme will be submitted to the Department of AYUSH as and when called for. The execution of the project will be monitored by a Committee chaired by the Director of the Central Research Council concerned with expert members identified by the Department of AYUSH, every six months. The Principal Investigator will make a presentation before the experts or a site visit may be arranged. The final outcome of the Project Will be evaluated by the expert group who will give their recommendation to the Department of AYUSH.

1.6 Department of Biotechnology (DBT)

17. The setting up of a separate Department of Biotechnology (DBT), under the Ministry of Science and Technology in 1986 gave a new impetus to the development of the field of modern biology and biotechnology in India. In more than a decade of its existence, the department has promoted and accelerated the pace of development of biotechnology in the country. Through several R&D projects, demonstrations and creation of infrastructural facilities a clear visible impact of this field has been seen. The department has made significant achievements in the growth and application of biotechnology in the broad areas or agriculture, health care, animal sciences, environment, and industry. As for internal mechanism of funding and implementation, the procedure involves internal screening, review by peers, task force committees, Biotechnology Research Promotion Committees (BRPC) and experts groups.

1.7 Department of Coal (DOC)

18. The Central Mine Planning and Design Institute Limited (CMPDI) is the nodal agency for coordinating R&D activities in Coal and Lignite sectors. The Ministry of Coal normally supports project of shorter duration (2-4 years). The findings of which, if completed successfully, can be used directly for commercial exploitation and benefit to the industry. However, in exceptional cases, research in newly emerging and front line areas of science and engineering and projects having long term implications can be supported.

19. Standing Scientific Research Committee (SSRC) of the Ministry of Coal under the Chairmanship of Secretary (Coal) is the Apex body to plan, programme, budget and oversees the implementation of research projects. The SSRC is being assisted by three Sub-Committees each dealing with one of the major areas. The research proposals are initially scrutinized by CMPDI. After the first level scrutiny, CMPDI shall submit these proposals with their own observations and recommendations to the Sub-Committee concerned. The Sub-Committee shall further evaluate the proposals and submit the proposal to SSRC for its consideration.

20. Once the project is approved by SSRC, a formal sanction letter is addressed to CMPDI. The implementing agency is required to furnish quarterly progress report in the prescribed format so as to reach CMPDI by 20th of the following month. CMPDI submits consolidated half yearly progress report to Ministry of Coal and to the members of SSRC. In case of major projects (costing more than twenty five lakhs with educational and research institutions and more than hundred lakhs with Coal companies), a Project Advisory Committee is constituted to review the progress of work.

1.8 Department of Ocean Development (DOD)

21. The development in Ocean Science & Technology is linked with achievements in other scientific and technological areas. The research efforts should lead to fundamental understanding and ensure predictive capabilities. An important component of he development Programme is technology. To be self reliant such technologies would have to be largely developed, tested and operated indigenously. Several new technologies will have to be commercialized and made cost effective. Creation of self reliant technological base puts a heavy demand on fully trained personnel and creation of infrastructure and facilities which has to be properly planned. Recognizing the above, the Department of Ocean Development (DOD) has reoriented Ocean Research & Manpower Development Programs and nine Ocean Science and Technology Cells have been setup in Universities/IIT with a view to create Centers of Excellence.

22. The Department clears the projects based on priority areas, the fulfillment of certain basic criteria regarding their objectives of direct relevance to ocean science, approach and competence available at the Institution/University/Organization etc.

1.9 Department of Science & Technology DST

23. The Department of Science & Technology plays a pivotal role in promotion of Science & Technology in the country. Science & Technology Policy-2003 states that "Special emphasis will be placed on equity in development, so that the benefits of technological growth reach the majority of the population, particularly the disadvantaged sections, leading to an improved quality of life for every citizen of the county."

24. The Department has wide ranging activities ranging from promoting high end basic research and development of cutting edge technologies on one hand to service the technological requirements of the common man through development of appropriate skills and technologies on the other. The Department supports research through a wide variety of schemes specifically carved out to meet the requirements of different sections of the scientific and engineering community.

25. Various methods, adopted for implementation and monitoring depending on requirement & suitability involve reference to experts/peers for evaluation, analysis by programmer Advisory Monitoring Committee, Constituting Steering Committee for the particular identified thrust area, and promotion of R&D in newly emerging and frontier areas of science and technology through high level peer review mechanisms like Science & Engineering Research Council (SERC). Peers and Expert Committees play distinct role in evaluation of proposals.

1.10 Department of Scientific and Industrial Research (DSIR)

26. The Department of Scientific and Industrial Research (DSIR) is a part of the Ministry of Science and Technology, which was announced through a Presidential Notification, dated January 4, 1985. The Department of Scientific and Industrial Research (DSIR) has a mandate to carry out the activities relating to indigenous technology promotion, development, utilization and transfer. The Technology Promotion, Development and Utilization (TPDU) Programmes are directed towards meeting the specific needs of industry and are of particular relevance in the present context. Programmes and activities under the scheme are centered around promoting industrial R&D, development and commercialization of technologies, acquisition! management and experts of technologies, promotion of consultancy capabilities, etc.

27. After initial scrutiny, the proposal is referred to experts and whenever necessary the site is visited and then proposal is considered by a screening Committee/Technical Advisory Committee.

1.11 Indian Council of Medical Research (ICMR)

28. The primary aim of the ICMR is to promote research in the country in the fields of medicine, public health and allied areas. The Council promotes biomedical research in the country through intramural research (through Institutes totally funded by ICMR) and extramural research (through grants-in-aid given to projects in non-ICMR Institutes).

29. The proposals are reviewed by Project Review Committees (PRCs) constituted by various technical divisions of ICMR far different subject areas. Most of these projects are also reviewed by subject specialists before being considered by the PRs. The progress of the project is evaluated by ICMR through appropriate peer review (Project Review Committees).

1.12 Indian Meteorological Department (IMD)

30. IMD was established in 1875. It is the National Metrological Service of the Country and the principal government agency in all matters relating to meteorology, seismology and allied subjects.

31. Proposal is referred to experts for its evaluation and viability and based on their recommendation it is considered for sanction. P.I is required to submit annual progress report which is evaluated by experts. Four copies of the PCR are to be submitted- PCR is referred to experts for their comments.

1.13 Indian Space Research Organization (ISRO) Department of Space (DOS)

32. The India Space Research Organization (ISRO) was established in 1969. The Indian space Programme has the primary objective of developing space technology and application programmes to meet the developmental needs of the country. Indian Space programme includes development of operational systems in the areas of satellite based remote sensing, telecommunications. broadcasting, meteorology and development of suitable launch vehicles for putting the satellite in various low earth orbits and geostationary orbits.

33. Proposals submitted to ISRO are evaluated by experts for its relevance to space programme. Progress of the project is reviewed by expert teams at ISRO.

1.14 Ministry of Communications & Information Technology (MOCIT) Department of Information Technology

34. Department of Information Technology (DIT) since its inception has been giving importance to research and development. Promotion of research & development efforts in electronics and related fields in the country has been one of the major activities of Department of Information Technology.

35. Evaluation and appraisal of project proposals is done through a Working Group consisting of eminent scientists and industrial experts and academicians, who recommend the proposals for consideration of funding by DIT. A Project Review and Steering Grouped (PRSG) comprising of representative from DIT and other experts periodically monitor the projects in technical and financial aspects.

1.15 Ministry of Environment and Forests (MOEF)

36. The Ministry of Environment and Forests is the nodal agency in the administrative structure of the central government for planning, promotion and coordination of environmental and forestry programmes. The main activities of the Ministry are conservation and survey of flora, fauna, forests and wildlife; prevention and control of pollution afforestation and regeneration of degraded areas and protection of environment. These tasks are being fulfilled through environmental impact assessment eco-regeneration, assistance to organizations implementing environmental and forestry programmes. Promotion of environmental and forestry research, extension and education and training to augment the requisite manpower: dissemination of environmental information international cooperation and creation of environmental awareness among all sectors of the country's population.

37. The following procedures applies to all suo-moto and invited (competitive) proposals, but not for commissioned research (non-competitive) proposals.

38. Submission of proposals for support for environment research: Suo-moto proposals for research support may be made at any time, and invited (competitive) research proposals upon invitation, to the designated Contact Person for the Research Programme in question. The applications should clearly identify the research questions, methodologies involved, and data sources. It should identify the complete Team of Investigators, and provide their detailed resume, highlighting their academic backgrounds and publications record. It should also specify the additional personnel support required, both scientific and support staff. It should provide a detailed break-up of the costs consistent with the Funding Norms. It should detail the equipment (including computers and peripherals) and instrumentation available, and that specially required for the project. It should provide the project time lines and milestones, and an indication of the Output of the project. Proposals should be made in the prescribed application format in hard and soft copy.

39. Proposals prepared by the Principal Investigator (PI) should be forwarded by the Head of the Institution. In case a research proposal involves a network of research institutions, the PI would identify the Lead Investigator from each of the participating Institutions with the approval of the Heads of these Institutions.

40. Scrutiny by the Contact Person: Proposals received by the Contact Persons, will be acknowledged within 5 working days. The Contact Person will determine the Order of Priority of the proposal in terms of the Thrust Areas.

41. Initial Appraisal by Thematic Peer Group: the proposal will be placed before the concerned Thematic Peer Group by the Contact Person, in terms of the "Good Practices for Regulation" Guidelines of the Ministry. The Group will determine if the proposal generally meets expectations of technical competence of the research team, completeness, and may result in useful research outputs which is potentially publishable in a peer reviewed publication of standing. If not, the proposal may be recommended for rejection at this stage. If not so rejected, the Group will identify a minimum of 3 and maximum of 5 Expert Peer Reviewers, having expertise in the specific research topic, to whom the technical proposal, as well as the proposed level of effort ("person-months") may be sent for evaluation.

42. Expert Peer Review: The technical proposals will be independently reviewed by the Expert Peer Reviewers within 45 days of receipt. All reviews which are received within this period will be placed before the Thematic Expert Group.

43. Final Appraisal by Thematic Peer Group: The Thematic Peer Group will consider the reviews from the Expert Peer Reviewers in each case, and determine whether or not the technical proposal may be accepted. They will also indicate whether the proposal level of effort ("person-months"), and equipment/infrastructure to be created by the project are reasonable and necessary.

44. Sanction by Ministry: The Contact Person will consider the recommendations of the Thematic Peer Group, scrutinize whether the financial proposal is consistent with the funding norms and the level of effort accepted by the Thematic Peer Group, and within 15 days of receipt of the recommendations from the Thematic Peer Group submit the proposal for expenditure sanction by the Ministry.

45. With respect to commissioned (non-competitive) research projects, sanction will be based on such technical evolution of the proposals as the Ministry may consider appropriate in each case.

1.16 Ministry of Food Processing Industries (MFPI)

46. The Ministry of Food Processing Industries (MFPI) was set up in July, 1988 to give an impetus to development of food processing industries in the country. The Ministry is concerned with formulation and implementation of the policies & plans for the food processing industries within the overall national priorities and objectives. The Ministry acts as a catalyst for bringing in greater investment into this sector, guiding and helping the industry, encouraging exports and creating a conducive environment for healthy growth of the food processing Industry.

47. The proposals are required to be recommended by the concerned State Government or Nodal Agency designated by them to the Ministry for approval. The proposals from PSUs, R&D Institutes, Universities. IITs and IIMs and other reputed State/National level institutes would not need such recommendations In case of areas

under autonomous bodies such as Gorkha Hill Development Council; such recommendations can be made by the Competent Authority.

1.17 Ministry of New & Renewable Energy (MNRE)

48. The Ministry promotes renewable energy technologies and creates an environment conducive or their commercialization through innovative policy initiatives and strategies. The range of its activities covers renewable energy resource assessment research and development, demonstration, extension and production in the areas of biomass energy, solar thermal and solar photovoltaic, wind energy and small hydro power. It also promotes and supports studies and research in new technology areas such as tidal energy,. geothermal energy, alternate fuels for transportation, hydrogen energy and fuel cells. The programmes of the Ministry are implemented mainly through the state energy development agencies and state electricity boards. Greater thrust has been given to research and development through active involvement of research institutions universities, industries and non-governmental organizations.

49. R&D proposals received by the Ministry are scrutinized in the light of R&D strategy for market orientation and 'commercialization. After initial scrutiny, the proposals are sent to Experts for comments. The expert comment along with the justification from the concerned programme division is placed before the R&D Committee(s) for consideration/approval. The projects are monitored by the concerned programme division directly and in some cases with the help specific Committees.

1.18 Ministry of Power-Central Power Research Institute (CPRI)

50. Ministry of Power, Government of India has entrusted the Central Power Research Institute to act as the nodal agency to manage the Research Scheme on Power [RSOP] including the funding for the Research programme. Techno economic evaluation, monitoring and optimal utilization of resources are the major responsibilities of CPRI. This was earlier carried out by CBI&P and is now being managed by CPRI, since April2001.

51. The projects are evaluated by an expert committee [RSOP-Expert Committee] constituted for this purpose. The committee comprises experts from different

organizations in the power sector like BHEL, NTPC. IISc. POWERGRID, CEA, CPRI State Utilities etc. The Governing Council of CPRI chaired by Secretary (Power), Govt. of India, is final authority for approving the recommendations of the RSOP-Expert Committee. Projects are monitored by RSOP Cell of the R&D Coordination Division of CPRI in Bangalore.

1.19 Ministry of Social Justice & Empowerment (MOSTE)

52. Ministry of Social Justice & Empowerment is the nodal Ministry for providing/implementing a wide ranging welfare measures in specific areas such as welfare for the handicapped. It also promotes development of aids and appliances through its Technology Development Programme.

53. After initial scrutiny the proposals are considered by respective Technical Advisory Groups (TAGs). The recommendations of the TAGs are placed before the Apex Level Committee (ALC) for its approval. The projects are monitored quarterly with the help of the experts from the TAGs and ALC.

1.20 Ministry of Water Resources (MOWR)

54. Provides financial assistance to promote research work in the field of Water Resources Engineering. The assistance is provided by way of grants to academic/experts in the Universities, IITs, recognized R&D laboratories. Water Resource/Irrigation departments of the Central and State Governments and NGOs. Research proposals of applied nature as well as basic research are considered for MOWR support.

55. Considering wide range of topics covered by Water Resources Engineering, five committees called Indian Committees (INCs) have been constituted to co-ordinate the R&D programme in conjunction with R&D Division, MOWS.

1.21 Petroleum Conservation Research Association (PCRA)

56. Petroleum Conservation Research Association is an organization which works under the ambit of Ministry of Petroleum and Natural Gas, Government of India. It has

been granted the prodigious task of endorsing conservation of petroleum products leading to environment protection for sustained growth among the individuals and institutions by the Ministry of Petroleum and Natural Gas. Research and Development is a major important activity of PCRA. PCRA has continued with its efforts towards new R&D projects aimed at accelerating conservation of petroleum products leading to environment protection, energy security and sustainable development.

57. After initial scrutiny, the proposal is placed before the Screening Committee on Resources, Environment & Conservation. Based on the recommendation of the Screening Committee, the proposal is processed for sanction. The project is monitored by the Department/Screening Committee.

1.22 University Grants Commission (UGC)

58. The UGC was set up on 5th November 1956 by an Act of Parliament for the promotion and coordination of university education and determination and maintenance of standards in teaching, examination and research. Presently UGC strives to promote teaching and research in emerging areas in Humanities, Social Sciences. Languages, Literature, Pure Sciences, Engineering & Technology, Pharmacy, Medical, Agricultural Sciences etc. The emphasis would be supporting such areas that cut across disciplines and subjects such as health, gerontology environment, biotechnology, stress management. WTO and its impact on economy, history of science, Asian philosophy and many other areas as would be identified by subject experts.

59. Annual Progress Report of work done must be submitted as per prescribed format. UGC organizes mid-term group review meetings of all the projects. The recommendations of the UGC Mid-term Evaluation committee would decide the continuance of the project.

D2-COMPARITIVE STUDY OF RESPONSES TO QUESTIONNAIRE

1	Name of Organisation	Indian Council of Medical Research ICMR, New Delhi	Indian Meteorological Department (IMD) New Delhi	Central Power Research Institute Banglore (CPRI)	Indian Council of Agricultural Research, New Delhi (ICAR)
2	R & D Expenditure	(2006-07) 5070.00 lakhs (Rs)	(2004-05)	Not Available	(2006-07) 1291.78 lakhs. (Rs)
3	Number of Projects	1412	1	Not Available	71
4	Whether Peer Review Practical	Yes	Yes	Yes	Yes
5	Procedure followed for peer review	Proposals are sent to 2/3 experts, discussion with PIs at ICMR in the Project Review Committee to take final view	At least 3 referees may be nominated for Peer Review Reporting Model.	Has sound review mechanism in place for R&D projects. Projects are periodically monitored and output peer reviewed.	Research Advisory Council Institute Research Committee, Quinquennial Review Report, Peer Review Team, and Plan Scheme Evaluation by independent agencies.
6	Any expansion or reduction required in procedure.	No	No	Greater transparency not required.	No
7	Any opposition/difficulty faced in above.	No.	No.	Govt. funding is very meagre and hence no further control required.	No.
8	Specify reasons for opposition	N.A.	N.A.	Too much of peer review would encroach upon IPR and freedom of researcher.	N.A.
9	Can non-conduct of peer review with genuine independence and objectivity can create conflict of interest?	Yes.	Yes.	-	Yes.

	Name of Organisation	Indian Council of Medical Research ICMR, New Delhi	Indian Meteorological Department (IMD) New Delhi	Central Power Research Institute Banglore (CPRI)	Indian Council of Agricultural Research, New Delhi (ICAR)
10	Whether peer review results should be clearly written with rationale of their conclusion and recommendatios for the sake of transparency and accountability.	Yes.	Yes.	-	Yes.
11	Your views on improving systems of Peer Review and whether; a) Peer Review should be mandatory b) Transparency will increase public's level of trust in profession c) Programme to increase pool of reviewers shall attract quality peer reviewers.	Yes. Yes Yes	Yes. Yes Yes	-	Yes. Yes Yes
12	Can peer review system can be reformed by : a. Providing rating on the qualities of applicants. b. Providing information on proposed budget for its realistic assessment.	Yes Yes	Yes Yes	–	Yes Yes

	Name of Organisation	Indian Council of Medical Research ICMR, New Delhi	Indian Meteorological Department (IMD), New Delhi	Central Power Research Institute Banglore (CPRI)	Indian Council of Agriculture Research, New Delhi (ICAR)
	c. Provide feedback to the applicants to improve research proposed.	Yes	Yes	–	Yes
13	Any other information to be shared :	(i) Peer review system in India needs a revamp with more transparency and accountability of reviewers. (ii) National systems of data/information sharing to improve the quality of review as also to identify and punish investigators indulging in unethical practices.	–	Existing review mechanism of DST, CSIR, BARC or CPRI are quite transparent.	–

60. Comparative study of few responses received indicates the importance of peer review in R&D funding and also, more or less, its transparency to improve quality of review. Peer review results which are transparent also help in better dissemination to those concerned for adoption by them. There are also few pertinent points that emerged from discussions in Interactive Meet. In view of shortage of peers in India, peer review data base would be useful. Further setting up an office of Research Integrity will help improve the system. Criteria for a peer should, perhaps, be related to the project criteria. Before initiation of providing a sanction, selection of project should be based on whether the same shall provide tangible benefits. One of the reform suggested in the system is providing rating on the qualities of the applicants by Peer Reviewers. Also suggested was

payment of an honorarium to the peers to expedite their response to the clearance. Project cost should also be basis for adopting selective yardsticks. Also there should be periodic reviews after sanction for mid-term corrections, if any. This has to be particularly rigorous for long term projects. Some agencies adopt three tier system of review involving (i) internal assessment (ii) peer recommendations and finally (iii) Task Force Committee. Final appraisal by a Thematic Group is also suggested. As justifiable, peer review serves only as input mechanism but not a guarantee for a favourable decision. In view of fear expressed by some, that peer review leads to encroachment of IPR, suggestion is made for a national policy to display the peer reviewed research projects. Practice of adoption of similar type of criteria for basic science projects and engineering projects needs to be corrected. As for audit it is advocated that peer review be broadly standardized to enable Audit to evaluate the performances, both financial and scientific in organizations.

E – ALLIED FACTORS IN PEER REVIEW

(E1-E2)

E1-PEER REVIEW IN FOSTERING REGIONAL INTEGRATION

1.1 Introduction

1. Organization for Economic Co-operation and Development (OECD) has brought out a Policy Brief in May 2007 on the subject "Fostering Regional Integration: Peer Review Southeast Asia". Though the subject is not directly related to R & D Funding it will be found that some principles and observations therein can be equally relevant for Transparency in Peer Review for R & D Funding. The Southeast Asian region has shown remarkable economic dynamism. Economic growth has been robust, and trade and investment flows have been soaring as a result of increasing international division of labour. In parallel, regional integration has recently deepened further and several initiatives for regional co-operation have been launched, especially since the Asian crisis in 1997. In particular, the concept of an ASEAN Community, proposed in 1997, has as its goal a single market and production base. In January 2007, the OECD held a regional dialogue about the role of peer review in fostering regional integration in Southeast Asia. Peer review has been a hallmark of OECD working methods for more than 40 years, and currently covers a wide range of policy areas. It has evolved over time to take account of new developments and new requests, such as involving civil society, business and labour.

2. Experience in the European Union shows the relevance of the peer review process in a regional context, and indeed peer reviews are not a new concept for Asian countries. In fact, the technique was used in ASEAN in the wake of the Asian crisis, and several international organizations, including the OECD, have carried out external peer reviews of ASEAN countries. Within Asia, peer review mechanisms have recently been developed in the framework of APEC and ASEAN+3.

3. Different organizations conduct peer review in different ways. Compared with other organizations, OECD peer reviews have several unique features. One of the important characteristics of peer reviews is their flexibility. Given their flexible nature, peer reviews could be tailored to fostering integration in Southeast Asia. This Policy Brief looks at how peer reviews can contribute to addressing regional challenges in Southeast Asia.

1.2 Background

4. Regional integration initiatives in Southeast Asia have a relatively long history, dating back to the creation of ASEAN in 1967. During the past 40 years, ASEAN (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam) has experienced ups and downs of economic cycles while doubling the number of its member countries. Amid such changes it has been evolving as an ever more integrated community. Regional co-operation in the ASEAN region accelerated in the 1990s, in particular after the Asian financial crisis. The concept of an ASEAN Community was proposed in 1997 with the end-goal of economic integration a single market and production base-as outlined in the "ASEAN Vision 2020" statement. Toward this goal, ASEAN in implementing a series of economic integration measures, laid down in the Bali concord II in 2003, which rests on three pillars: the ASEAN Economic Community, the ASEAN Socio-Cultural Community and the ASEAN Security Community. Recently, ASEAN countries agreed to accelerate the schedule to achieve these goals by 2015. The ASEAN has endorsed 11 priority sectors for integration including agriculture, electronics, healthcare, ICT, tourism, etc. Mid-term action plans to achieve the goal of an ASEAN Community were agreed: the Vientiane Action Programme covers the period 2004-2010 following the Hanoi Plan of Action for 1999-2004.

5. Co-operation has indeed advanced substantially in some areas. For instance, in the area of trade, as a step towards establishing a full-fledged ASEAN Free Trade Area, the common Effective Preferential tariff (CEPT) scheme was established in 1992 and ASEAN member countries have made progress ahead of schedule in lowering intra-regional tariffs. As a result, in general, intra-regional tariffs have been reduced to between 0% and 5% and member countries are aiming at a complete elimination of tariffs. The Asian crisis in the late 1990s acted as a trigger for enhanced financial co-operation in the region. Mutual trust and information sharing are prerequisites for co-operation in this area. With the aim of ensuring adequate liquidity levels to reduce the risks of another crisis, a framework of bilateral swap agreements has been established. The development of an Asian bond market has also been encouraged in order to secure longer-term financing, while additional measures to mitigate risks such as in the area of financial infrastructure have also been identified. Importantly, co-operation has strengthened in the area of regional surveillance. The Asian crisis triggered enhanced

co-operation not only in the area of finance but also with regard to foreign direct investment (FDI). Creating a favourable investment climate is important to attract FDI. With the ultimate aim of making investment barrier-free, ASEAN embarked on a process of investment liberalization, facilitation and promotion in 1998.

1.3 Peer Consultation Process

6. ASEAN countries have been facing a number of regional challenges in various areas such as intellectual property rights, industrial co-operation and enterprise development, science and technology, ICT, energy food, agriculture and forestry. Following the 9th meeting of the ASEAN Senior Officials on Forestry (ASOF) in August 2006, a "peer consultation process" has been launched in this specific sector, starting with Brunei, Cambodia and the Philippines. Regardless of the area, an important issue in fostering regional integration in the ASEAN is how to cope with large income difference among member countries. Narrowing the development gap has been recognized as a policy priority and measures to address this issue started in 2000.

7. The peer reviews mechanism-the assessment of the policies and performances of a country by other countries-is at the heart of OECD's method of work. It is a tried and tested instrument that helps member countries improve their policy making, adopt good practices and generate established standards and principles. This method of international co-operation has become increasingly popular in recent years, even beyond OECD borders. The scope of the peer review mechanism has expanded rapidly it terms of policy areas reviewed and the number of organizations involved. The success with peer reviews has encouraged other organizations to adopt this tool and the OECD has started to discuss experiences of peer reviews with ASEAN. Peer review can serve as an important capacity-building instrument since it is a mutual learning process, which allows best practices to be tested and emulated. In many different settings, the "soft law" nature of peer review can prove better suited to encouraging and enhancing compliance than traditional enforcement mechanism. It has been observed that where regional integration projects involve deepening legal and economic commitments, it is important to disentangle sanction regimes from peer review to ensure that the fee disclosure of information is incentive compatible.

8. Based on solid analytical evidence, the review results in a series of recommendations reflecting the collective wisdom of participants, that aim to support the reform efforts of the country under review. Important prerequisites of peer reviews are the sharing of common values, mutual trust and the analytical credibility of the review process. A strong common understanding of the ultimate goals of the peer review and a high degree of shared confidence in the value and integrity of the process are keys for its success. Peer reviews are a flexible tool in terms of the policy areas and countries to be covered. In the real operation at the OECD, different methods are used for different policy areas. Peer review can apply not only to country-by-country examinations but also to cross-country thematic reviews or to broader issues of regional co-operation. The impact of this exercise can vary according to the pactical details of the implementation, and the degree of mutual trust among participants.

9. Peer review is not a new concept for Asian countries. Indeed, since the Asian crisis in 1997, peer review has been institutionalized as the ASEAN Surveillance Process. ASEAN countries have also been subject to external reviews conducted by international organizations such as the IMF and the World Bank. Importantly, the traditional ASEAN approach of non-interference has started to evolve. At the 12th Summit in Cebu, the Report of the Eminent Persons Group on the ASEAN charter invited Members to *"calibrate the traditional policy of non-intervention in areas where the common interest dictates closer co-operation"*. APEC has also adopted the peer review approach, as a useful tool to foster regional integration, and it has been introduced in the framework of ASEAN+3 (China, Japan and Korea)

1.4 Processes of Peer Review

10. Different organizations conduct peer reviews in different ways. For instance APEC has been using peer reviews as a tool to achieve the common goals of free and open trade and investment in the Asia-Pacific region. These goals, known as the Bogor Goals, were laid down in the Bogor Declaration in 1994. In their path towards achieving the Bogor Goals economies prepare individual action plans (IAPs) tracking their progress. These IAPs then become the object of the peer review process, which has evolved through trial and error. At the outset, the submission of IAPs for peer review was conducted on a voluntary basis, and then in the early 2000s, the process was made more

rigorous. As part of the mid-term stock-taking process in 2005, a timetable was set for the reviews of all 21 member economies. The IAP peer review process has proved to be an effective tool to facilitate learning from each other's experiences, enhance policy-relevant interaction and encourage participants to progress towards the goals of free and open trade and investment.

11. As another example, in response to the Asian crisis, ASEAN+3 have adopted the Economic Review and Policy Dialogue (ERPD) process as part of their efforts towards regional financial co-operation. They have recently decided to integrate the ERPD with the regional liquidity support facility, the Chiang Mai Initiative. In addition, National Surveillance Units have been set up in ASEAN+3 countries for economic and financial monitoring. The ultimate aim is to strengthen the Chiang Mai Initiative as an independent facility from IMF programmes and to transform it into a multilateral arrangement. This requires a more active and effective role for the ERPD, whose major role has so far been information exchange and coordination. Information exchange is the first evolutionary step of the ERPD and is a prerequisite to peer review and due diligence. Information sharing is crucial in the areas of macroeconomic development and in support of institutional, legal and regulatory reforms in the areas of foreign exchange and financial markets. It is argued that for the ERPD to become a more powerful tool, both its peer review and due diligence features need to be enhanced.

12. Within the ASEAN, peer review was institutionalized after the Asian crisis as the ASEAN Surveillance Process, although it's still at an early stage. The main objective was to avoid future crises by providing countries an opportunity to exchange information and thus raising overall quality of governance in the region. International organizations supported this process and welcomed information sharing of the regional economy and of the ways in which individual countries are affected by common threats and common problems.

13. The OECD peer review process has several unique characteristics. The OECD's useful role lies in bringing together the independent analytical capacities of the secretariat and the policy experience of national government officials. The secretariat helps to identify the specific issues on which to focus the review and ensures the quality of the

methodological instruments. By adding a detailed discussion with the relevant national officials when the Secretariat's draft is presented to the Committee, the process allows to find formulations of policy recommendations that are endorsed by national governments, thereby helping to build consensus amongst participating committees or working parties dealing with a particular issue who can decide to undertake peer reviews as part of their activities, or to carryout a one-time peer review at the request of a country or a region. The various Directorates in the OECD Secretariat constantly adapt and improve the modalities of the peer reviews to meet the specific requirements of the policy area concerned. There is no standardized peer review mechanism as such, but all peer reviews share certain structural elements: a commitment to transparency and information sharing; an agreed set of principles, standards and criteria against which performance will be reviewed; designated actors to carry out the review; and a set of procedures leading to the final result.

1.5 Concluding Remarks

14. The First OECD – Southeast Asia Regional Forum was held in Jakarta in January 2007, hosted by the government of Indonesia, in co-operation with the ASEAN Secretariat and the Asian Development Bank (ADB) to discuss OECD experiences with the peer review mechanism and to share lessons learned from multilateral and regional experiences in the region. OECD member countries, including Australia, Belgium, France, Japan and Korea shared the lessons they learned by participating in OECD economic and development reviews and in peer reviews in a number of other areas. The European Commission, ADB and APEC discussed their experience with peer reviews in their regional context.

15. Several points need to be taken into account when considering an application of peer reviews to the Southeast Asian region. The integration process in Southeast Asia has some features of its own-for instance, it is mainly market driven and it is taking place in the presence of regional diversities, including large disparities in the level of development. Appropriate adjustment to the standard peer review process may be required to take such characteristics into account. Moreover, further adaptation may be needed according to the area of co-operation. Various examples of peer reviews in different institutions will provide useful references for developing the most relevant

framework for ASEAN. A number of ASEAN countries are already participating in OECD activities in various policy areas where their domestic policy challenges are analysed and discussed for the benefit of all. Improving the policy environment at national level is often critical to addressing broader regional challenges. As part of its ongoing dialogue and co-operation with Southeast Asian countries, the OECD stands ready to continue both to help policy makers in their reform initiatives at national level and to contribute its experience with peer reviews in support of regional integration efforts.

E2-BICAMERAL REVIEW OF RESEARCH PROPOSALS

2.1 Research funding & Peer Review

16. New initiatives in business and industry need, first and foremost, bright and well informed people. In the right environment they will come up with ideas. Then funds have to be committed to test the ideas: People, ideas and funds are thus the key components in research. Researchers apply for funds to funding bodies. A successful financier has to be very shrewed in deciding among the entrepreneur review. Equally important is the proposal submitted by researcher. The proposals must contain a review of the published work, a hypothesis and the experiments designed to test the hypothesis. They must spell out the implications of the new knowledge they expect to obtain and provide a detailed budget.

17. It is felt that we expect too much from the peer review process. First we expect it to provide ratings on the qualities of the applicants, second we expect it to provide information on whether the proposed budget are realistic and third we expect it to provide feedback to the applicants so that they can improve the research proposed. A 'reform' in the form of 'Bicameral' method of reviewing research proposals seems to be answer.

18. It would reform the peer review process by separating grant applications into two distinct parts, a retrospective part and a 'prospective part. Peer-review should be entirely retrospective and concerned with past performance relative to funds received. Prospective review concerned solely with budget, should be performed in house by the funding bodies. After this bicameral review all that would remain would be to rank the applicants by rating decide on a rating cut off point and then allocate funds. Scope of the study calls for detailed study of the systems with inherent pros and cons.

2.2 Principles and Practice

19. Evaluation by one's own equals is both essential and unavoidable where-ever reputable science is done. Every researcher applying grants has been evaluated since kindergarten, through doctoral and post doctoral studies. The critical question is whether peer review by the funding agency adds a dimension missing from all previous reviews- If

so, it is necessary. If not, it is superfluous —at least at the level of intensity that now prevails. Over-review is as unproductive as under-review. Concept needs further deep analysis from various pertinent angles.

2.3 What actually happens under the System

(i) Involves high costs of preparing and processing grant applications.

(ii) The rat race of grant getting may paradoxically contribute to lack of productivity

(iii) Researcher dropout — many first class scientists are being eliminated completely and numerous others discouraged into apathy.

(iv) Grantmanship has become one of the games people play. There are good grant-getters who are uncreative researchers and poor grant getters who enjoy grant respect. Grantmanship can also become a substitute for scholarship and a bridge to academic tenure and promotion.

(v) Proposals are often history — It is extremely wasteful, because so much time and money is spent on evaluating the prospective value of work that has already been carried out.

(vi) The present system creates extreme anomalies. For instance, a creative, proven researcher may on the basis of poor review be abruptly cut or terminated. There has been a case where a person who won a scholarship from one committee, but was denied operating funds by another of the same agency.

(vii) The present system undermines the morale of researchers, especially of research technicians. For the agencies to take the position that they do not employ technicians, only fund researchers (i.e. proposals) is short sighted, considering that the two thirds of the grant monies go to pay technicians who do most of the bench work. Their quality determines the excellence of what comes out of our laboratories.

(viii) System is least effective where most needed. It readily weeds out the very bad applications, but is questionably effective in discriminating among the good, better and best.

(ix) The present system of review excludes all local knowledge of the applicant. Local advocacy should be included in an assessment. Case has been of

scientists who won tenure and promotion on the basis of a stiff international review that established their credentials beyond any reasonable doubt but got rejection slips from a grant agency! which implied incompetence.

(x) No defence — our legal system, as well as common everyday decency, precludes judgment of an individual without defense.

(xi) There is no review of the quality review. These people can write anything and get away with it. A system to disqualify reviewers is called for.

(xii) No continuity of review — A proposal turned down one year for the wrong reasons registers unfavorably for the applicant. The appropriate thing would be for this year panel to recognize that last year panel has misjudged the case, and that some allowance should now be made.

(xiii) No appeal system — criticisms are made, applications are turned down: the applicant and those connected with him are subjected to extreme anxiety and hardship, all as a result of a secret process carried on without defense or appeal.

(xiv) The problem of plagiarism — A system that compels applicants to spell out their detailed research plans every 1-3 years invites plagiarism by both scrupulous and unscrupulous colleagues. Things get worse if a proposal is not funded and someone else, possibly one of the people instrumental in turning down the proposal, is free to use those cherished thoughts while their originator is not. Plagiarism robs the system, as well as individuals, because plagiarists get a free ride and damage morale.

20. The granting agency system has additional undesirable side effects. Its insecurities generate inner compulsions to apply for bigger bucks each year. Big bucks afford greater protection from the guillotine. Bucks act as a security blanket, of which we crave more and more in a threatening system.

21 The Goal — where we want to get to, of course, is a quality of research that is equal, or superior to what we now have under a system of funding that is more humane and much less expensive, burden-some and distracting. In other words, we want more productivity with less overhead.

2.4 Broad underlying principles

22. Broad principle is that first the change from the present system is urgently needed. Second the destructively competitive aspects of the present system are not necessary for excellence to prevail. Third, peer review can be fully expressed in systems that differ from the present one whereby peer review is applied sensibly. Fourth, scientists must take precedence over proposals. Fifth, a scientist's track record (not his proposals) is the surest indicator of future prospects. Sixth, research workers are selected by their institutions and not by the grant agencies. Seventh, the virtue upheld by some proponents of present system that shrinking financial pies should be sliced into fewer larger pieces for the fittest must also be questioned. The performances of "giants" who have hogged larger pieces of pie have often been neither durable nor excellent.

2.5 Alternate Models

23. Grant applications mainly try to achieve following benefits

(i) Researchers are encouraged to complete and document their work.

(ii) Careful planning is fostered

(iii) The work is subjected to scientific criticism

(iv) The budget can be trimmed to suit the work.

24. These are underlying reasons for the system as it exists, and they could be readily preserved in alternate models.

2.6 The Department Model

25. This is a much maligned model typed as a sure passport to nepotism, waste and dismissal mediocrity and, yet, this system has fostered, Nobel winning science in Britain, Australia, Belgium and several other countries. The important principle is that the cost and effort of agency review would be invested to motivate scientists, improve their research, and regulate their budgets more closely to the real need. Such review would be far more rewarding to the reviewers than the guillotine variety. There would be fruitful co-operation instead of vacuum between the researcher's two joint bosses, namely the department which pays his salary and the agency which provides his direct operating costs.

2.7 Productivity model

26. Basically researchers would remain innocent until proven guilty. Acknowledging the necessary differences in treatment between new and established scientists the process would basically involve an annual submission of a list of publications, together with supporting data. For instance, the significance of each paper could be outlined in the applicant's own words in a short paragraph including such information as whether it represents a break-through or merely confirmatory evidence, a new method or just an improvement. In most cases, the entire application could be dealt with-in minutes by a well-chosen panel, in house, without external review. The latter is automatically incorporated in the publications. The system is altered to build rather than to destroy delivering scientific value into the system instead of just decapitations. It also implies the existence of an appeal system.

2.8 Existing System with improvements

27. Failing all else, five obvious improvements could be made to the present system.

(i) Greater emphasis on productivity than on proposal-In such cases, the reviews would not translate so easily into 'grant' vs 'no grant' but would be used as warning signals to the applicant.

(ii) Signed reviews - Four factors are often forgotten or underestimated First scientists wear no masks to hide theft identity when they criticize each other's work verbally in public at scientific meetings- Second a signed, critique is bound, to be more scientifically responsible, which is surely needed when so much is at stake, Third there is compensation for the vulnerability of self-revelation- Fourth the issue of signing is usually treated as a matter of personal preference, when in reality it is not- Taking all factors into consideration, one could seriously argue that the innocent have nothing to fear when they sign reviews- Those who are adamantly opposed, whatever their stated reasons, may really be trying to hide carelessness or wrong-doing and should be disqualified- The reminder also has to be fair.

(iii) Appeal System — All reviewer's comments, most certainly critical ones, would be transmitted to the applicant, preferably before the panel meets, providing opportunity for rebuttal-

(iv) Fairer Reporting — Scientists are grown up people who deserve more than the terse bureaucratic refusal notes they get after investing so much in their application.

F – PEER REVIEW – PRESENT AND FUTURE

F-PEER REVIEW – PRESENT AND FUTURE

1.1 Introduction

1. In October 2006, European Science Foundation (ESF) the Czech Science Foundation (GACR), and European Heads of Research Councils (EuroHORCs) organized an international conference in "Peer Review – its Present and Future State" in Prague. High level representatives of major research - funding and research-performing organisations were invited to present their approaches to the peer review process in their respective institutions. The enormous response to this invitation was an indication of great interest in this topic. It strengthened shared belief that presenting and discussing the practices of peer review with an international audience offers an opportunity to learn from each other. The conference, with more than 30 contributions, was organised in two plenary and eight parallel sessions. The conference was attended by more than 150 delegates from European institutions as well as institutions from the United States, China, Japan, and South Korea. Active contribution by speakers and participants is reported to have led to lively and interesting discussions from a great variety of perspectives. Activities, in brief of the above mentioned three organizations are:

1.2 European Science Foundation

2. The European Science Foundation (ESF) was established in 1974 to create a common European platform for cross-border cooperation in all aspects of scientific research. With its emphasis on a multidisciplinary and pan - European approach, the Foundation provides the leadership necessary to open new frontiers in European science. Its activities include providing science policy advice (Science Strategy); stimulating co-operation between researchers and organisations to explore new directions (Science Synergy); and the administration of externally funded programmes (Science Management). These take place in the following areas: Physical and engineering sciences; Medical sciences; Life, earth and environmental sciences; Humanities; Social sciences; Polar; Marine; Space sciences; Radio astronomy frequencies; Nuclear physics. Headquartered in Strasbourg with offices in Brussels, the ESF's membership comprises 75 national funding agencies, research performing

organizations and academies from 30 European nations. The Foundation's independence allows the ESF to objectively represent the priorities of all these members.

1.3 Czech Science Foundation (GACR)

3. The Czech Science Foundation (GACR) was established in 1993 as an independent institution. The basic aims are:

(i) To provide financial support for excellent research projects and at the same time to audit effective use of the financial means;

(ii) To promote high-level research through long term funding, based on peer review evaluation of submitted proposals, science-policy expertise and global cooperation;

(iii) To raise the public understanding of science and to enhance the esteem and social status of scientific research;

(iv) To develop high-quality research environments and to improve the scientific career opportunities;

(v) To support multi- and interdisciplinary research projects and communications;

(vi) To represent Czech science among the international research organizations and in national and international scientific bodies;

(vii) To cooperate and support international scientific co-operation of research projects through agreements with research councils all over the world.

1.4 European Heads of Research Councils (EUROHORCs)

4. EuroHORCs is the association of the Heads of public national research and research funding organizations in Europe. It was established in 1992 as an informal association of national research councils and analogous public non-university research organizations of the EU Member States. The last few years EuroHORCs has become an active player in the field of European research policy by promoting and enhancing inter-council cooperation and serving, amongst others, as advisory body for the European commission. EuroHORCs seek to enhance the role of the national research and research funding organizations in Europe through creating a platform for discussion, initiating joint activities and strengthening their influence on European research policy.

1.5 Conference Discussions

5. Conference was attended by high level representatives of major research funding and research performing organization who presented their approvals to the peer review process in their respective institutions. The conference was attended by more than 150 delegates from European institutions as well as institutions from the United States, China, Japan and South Korea. The aim of the conference has been to analyse contemporary trends in the evaluation of research, to examine how the peer review process is understood and performed and to consider its future modifications in response to the requirements of research in the 21st century.

6. As a general focus, the theme of the conference was organized along three questions:

i) Is peer review in the present form able to identify the best and most innovative frontier science and how might it be improved?

ii) What is the best way to harmonise the peer review process and how can new methods and IT tools contribute to it?

iii) What are the major societal, cultural and ethical challenges of future peer review processes and how could they be incorporated?

1.6 Peer Review in Pan-European Research Funding Schemes

7. In recent years, Europe has witnessed the development of new research funding programmes to improve the collaboration of researchers across national borders. Most of those competitive grant schemes rely on peer review mechanisms for the selection of proposals. After proposal submission which, depending on the programme, may be in the form of a pre-proposal, an eligibility check is made according to requirements specified in the call for proposals. The proposals are then reviewed by external evaluators selected from a large pool of possible referees. Individuals listed in this pool are either proposed by institutions or by themselves in response to calls to register as potential evaluators. The European Commission may also select evaluators not listed in the pool. The evaluators sign a declaration of confidentiality and a conflict of interest form. Their names are published after the evaluation. The evaluation criteria are pre-

defined and may be differently weighted according to research area and the aim of the research Programme. In FP6, these criteria included ethical considerations and gender issues in addition to science and societal issues. The main objective of Framework Programme (F P7) is strengthening the scientific technological base of European industry and encouraging its internal Competitiveness through research that supports EU policies. Grants under 7th Framework Programme are determined on the basis of calls for proposals and a peer review process, which are highly competitive. Brief particulars of FP7 which will last from 2007 until 2013 are enclosed as Annexure III.

8. Each proposal is reviewed by three or more evaluators who give marks and comments, on the basis of which a consensus is sought. A panel meeting compares the consensus reports and makes suggestions on the order of priority. During this process, hearings with grant applicants may be convened. The European Commission sends the evaluators evaluation summary reports to grant applicants, draws up the final ranking list and takes the final funding decisions based on the advice of the experts. For the future, the EC aims to further improve current procedures while maintaining continuity with current practices in the Framework Programme which proved to be efficient. Improvements include the increasing use of IT tools to enable reviewers to have remote access to the proposals. Efforts to include high quality researchers in the review pool will continue, in particular through using remote evaluation. The criteria, adapted to each instrument, will be divided into three distinct sets: the scientific (and technological) quality of the proposal, the likely impact and the quality of implementation.

9. European Young Investigator (EURYI) Awards scheme was created in 2003 by EuroHORCS in collaboration with ESF. The selection of the awardees is organised in two steps: the first selection step is handled by the national research councils and the second step is undertaken by international panels established by ESF. Approximately 120 proposals enter the second stage. Out of which 25 are selected. In the second stage six broad disciplinary panels make the assessment. In establishing the panels (with about eight members each) scientific record is the main criterion and a balance of gender, expertise and geography is taken into account. All panel members read and individually score the applications. Grant applications deviating from the average are discussed and a preliminary list is established. Starting from the top of the tentative list, all applications are discussed, each with a selected spokesperson. This results in a

rearranged list with decisions about which applicants to invite for an interview. About 60 candidates are interviewed. The interviews are seen as important because they give insights into the true potential and creativity of the candidate.

10. Scientific Council of the European Research Council (ERC) presented the peer review process to be used in 2007. The launch strategy of the ERC foresees two funding schemes on a bottom-up basis: the ERC Starting Independent Researcher Grant scheme (ERC Starting Grant) and ERC Advanced Investigator Researcher Grant scheme (ERC Advanced Grant). The ERC Starting Grant supports researchers at the start of establishing their first independent research team in all areas of research. The ERC developed a peer review mechanism in which the review of the proposals is made by disciplinary panels (with about 12 members each) and is done in two stages: First selection by the panel of twice the number of grants to be distributed and second panel evaluation based on reviews and interviews. The criteria are: the excellence of the project submitted and the potential of the applicants (research excellence, achievements, and publications). To identify outstanding researchers to serve on the 20 panels, major scientific organisations in Europe were approached to nominate candidates. Using these nomination lists and other sources, the scientific council of the ERC has identified a large pool of names (about 500 names) suitable for the constitution of balanced panels, inclusive in all respects.

1.7 Peer Review and Selection of Proposals in National Funding Agencies

11. Presentations included peer review process in two US and one Japanese organizations namely the National Institutes of Health (NIH), the National Science Foundation (NSF) and the Japan Society of the Promotion of Science (JSPS). Studies of the two European institutions complemented the picture on challenges fund by peer review systems in national research funding agencies. NIH annually funds grants totalling more than US$20 billion supporting more than 200,000 researchers at over 3000 research institutions in the US. It receives about 80,000 grant applications a year and engages about 18,000 reviewers. To adapt to changes in the research environment, changes were introduced: (i) communication with stakeholders was increased, (ii) summary statements were made more uniform, and (iii) electronic systems are being

used to increase efficiency. More efforts are being undertaken to: (i) shorten the review cycle, (ii) do more to recruit and retain more high quality reviewers, (iii) decrease the burden on applicants and reviewers, and (iv) improve the identification of significant, innovative and high-impact research. The use of electronic review modes is being tested. Other measures being considered to enhance efficiency include reducing the size of applications and shortening the review meetings.

12. The NSF handles approximately 40 000 proposals a year (of which 10 000 are new grants) that are reviewed by approximately 50 000 volunteer referees. The proposals are funded according to their merit, assessed against two criteria: (i) what is the intellectual merit of the proposed activity? and (ii) what are the broader impacts of the proposed activity? The Increasing complexity of science and engineering research and the broader mission of NSF increase the need for a diverse, inclusive and expanding pool of reviewers. A combination of researchers at an early stage in their career with more established ones, of individuals from different fields with a variety of intellectual perspectives, helps ensure that diverse viewpoints contribute to the process of identifying the best ideas. The programme officers at the NSF and the advisory committees play an important role in ensuring high quality merit reviews. The programme managers, who either are permanent NSF staff or rotating from universities and other institutions, identify and manage merit review panels, recommend proposals for funding, balance a wide range of considerations in shaping the programme portfolio that they manage. The advisory committees (outside experts from industry, academia and other government agencies) to each NSF directorate and major office evaluate NSF performance and provide feedback on new directions and improvements to NSF programmes. The ways to strengthen the merit review process at NSF include: improving training for programme managers; building an expanding pool of diverse, highly qualified reviewers and developing new mechanisms to increase the transparency of the merit review process.

(i) Japan

13. Japan Society for the Promotion of Science (JSPS) received about 88000 applications in year 2006, selecting about 22000 of them. More than 4100 document reviewers and 700 review panel members were involved during this process. In 2003 the

JSPS established a 'Research Center for Science Systems' which has three main functions: (i) to oversee application screening and project assessment for JSPS programmes, (ii) to conduct surveys on science promotion policies and research trends, and (iii) to provide the JSPS administration with recommendations on issues such as improving its screening and assessment functions and designing future funding schemes. The center is staffed with 113 programme directors and programme officers, top-level researchers in their fields, who work at center part-time on three-year tenures. New officers are chosen from different institutions. Upto 2004, the reviewers were recommended by the Science Council of Japan and from 2005 onwards they have been chosen via an autonomous procedure at JSPS's Research Center for Science Systems. Reviewers are selected from a dedicated database that includes more than 40 000 potential reviewers. The JSPS has increased the number of reviewers so that they will review no more than 200 proposals each.

14. Mechanisms to ensure the quality of the selection process and clearly defined procedures to handle any conflict of Interest have been developed. To enhance transparency the screening policy and evaluation criteria are published in advance and reviewers' names are disclosed at the end of screening period. On request, unsuccessful applicants are provided with the following information: (i) their ranking within their subject category on a three-grade scale, and (ii) the average score awarded by reviewers for each evaluation criterion.

(ii) U.K

15. Engineering and Physical Sciences Research Council (EPSRC) in UK handles about 5000 applications yearly and it involves a peer review college (whose members serve three-year terms) based on nominations by the research community and representative factors including gender and professional background. The peer review operations at the EPSRC are audited according to the quality management system ISO 9001. Peer reviewers are expected to be appropriately receptive to high-risk high potential return proposals. These can be defined as research activity where there is a considerable amount of uncertainty about the success, because completely new questions are being asked, new methods are used or new people are involved. It was

felt that current system may have failed to adequately address such proposals. The EPSRC established a separate adventurous interdisciplinary research fund (1-2% of total available funds) devoted to proposals, which may be characerised as high-risk/high uncertainly in the proposal but high impact if successful.

(iii) Germany

16. Members on the review boards of the Deutsche Forschungsgemeinschaft (DFG)-Elected by the researcher community in Germany, the 577 members of 48 disciplinary review boards evaluate both the proposals of applicants and the reviews by referees from a scientific perspective. This also serves to ensure the appropriate selection of reviewers.

17. The results of an on-going survey of the members on the review boards of DFG addressed a range of issues: from the perceived fairness of the peer review system to the perception of the burden imposed on the scientists involved. The partial results showed that the members of review boards are critical in judging the quality of reviews whereas, in most aspects investigated, the great disparity across scientific disciplines was striking. The respondents were in favour of rewarding the reviewers in their own currency (peer recognition etc.') They regarded science as international and did not see any special advantages of involving more foreign reviewers. Against the background of the debate about the anonymity of reviewers, it was concluded that establishing a review board seemed a good compromise between keeping the anonymity of the reviewers and the interest of the public. The respondents did not recommend the open review model (in which reviewers are known). The survey also showed that there was a strong call for open access to findings of funded projects by the respondents.

18. DFG in Germany identified two major problems the peer review is inherently confronted with: *'On one hand as it is a part of a decision- making process that has to produce clear results, on the other hand it operates under conditions of high uncertainty'*. As the peer review process is central in allocating rather scare resources (research funds, journal space, recognition), it stirs strong feelings. The main criticism the peer review system faces is that, *'being a social activity'*, it involves human beings who may

fail to recognize the true merit or simply have no time to properly review the grant. A 'thought experiment' identified six mechanisms to allocate research funding which could be alternatives to peer review systems as currently practiced:

(i) Decision by bureaucrats
(ii) Decision by political correctness
(iii) First come, first served strategy
(iv) Lottery
(v) Decision by indicators
(vi) Enlightened absolutism.

19. Reflection on the problems above mentioned alternatives cause in that there is no alternative to peer review. The challenge is not to replace the existing system but to improve it and to overcome its weaknesses and drawbacks. Key issues are a paper management of proves and establishing sound safeguard mechanisms to minimize biased conflict of interest.

1.8 Peer Review in Scientific Publishing

20. In scientific publishing peer review has been used for centuries to assess the merit of papers being submitted. It is a mechanism to ensure the rigour and accuracy of scientific research and as such serves also to give the public confidence in the quality of published results. This is even more important today when science is abutting ever more closely with core human values stem cells, cloning and energy for the first time in many years of scientific history.

21. Measures to improve the quality of peer review include:

i) Continuing to review and revise processes of peer review in journals
ii) Transparency: clarifying author contributions and potential conflict of interest
iii) Using measures to detect anomalies in data
iv) Exploring new models of peer review

22. Discussing the limits of peer review, it is opined that peer review assumes honesty and is based on trust. It can help establish scientific validity and rigour but it offers no guarantees.

23. New models of peer reviews make use of new ICT advances and tools, the group review, the open review and the continued review. Group review is used, in computer sciences where refereed conference papers are the main means of information dissemination. Three to five months between submission and the conference the programme committee conduct Web-based discussions on the papers. Two to three members write an initial assessment that other committee members discuss further. This approach is seen as likely to identify breakthroughs and is seen as a fast process of quality assurance. In the Open review process, the paper is available online for review by the scientific community at large. The advantages of this model are, among others, that the paper is likely to increase its quality as comment goes on, the high probability of recognising break through and-because of the 'shame factor' - authors are not encouraged to post 'bad papers' and reviewers are likely to write good reports. The reviewers are rewarded by the fact that reviews are mini-publications in their own right. In the Continued Review, the articles are continuously reviewed after publication. A track of citations and downloads is kept during this process, comments are continuously made by readers, and articles are amended by authors accordingly.

1.9 Assessment and Selection of Research Proposals (National)

24. Peer review remains the central instrument used by research-funding agencies to identify which are the best research ideas to support. However, given the changes in research practices, together with the increasing number of research proposals received and organisational changes in national science systems, the practical approaches to peer review must also reflect these developments. It is noted that interdisciplinary research had received renewed attention in recent years but that few funding schemes have been specifically developed to support interdisciplinary research. This has led to some concern regarding the appropriateness of the current peer review procedure for its evaluation. One of the main arguments was that peers use disciplinary criteria for making their assessments, thus creating a potential bias against interdisciplinary research.

25. Looking at the type of research the Academy of Finland funds, the study found that 42% of the projects were either multi- or interdisciplinary. The study also showed that the

interdisciplinary nature of research proposals did not seem to influence their success rate, which was approximately 20% for both single disciplinary and interdisciplinary research proposals. It was concluded that the evaluation system used by the Academy of Finland was efficiently handling interdisciplinary proposals. The results were seen to be consistent with the outcomes of international research on the funding of interdisciplinary science. It was important to distinguish between 'interdisciplinary research' and 'radical science' (i.e. unconventional, risky or adventurous science). The findings challenged the commonly held view that reviewers can be biased against the innovation of interdisciplinary proposals. It seems that interdisciplinarity is a more common phenomenon in science than is generally believed, suggesting that it has not been marginalised or even slowed down by the peer review system.

(iv) Korea

26. In its efforts to improve the country's standing in science and technology the research system in Korea has undergone a massive restructuring, in the course o f which Korean Science and Engineering Foundation (KOSEF) saw its activities expanded (from basic science research to large-scale R&D programmes) and its annual budget increased (to approximately US$1.5 billion in 2006). In this context, KOSEF needed to reorganize its evaluation systems to accommodate both basic research programmes and national R&D programmes. A Standardised Evaluation Process (SEP) was introduced, covering the pre-funding, progress and post-funding evaluation. In addition, a new system for categorizing research programmes was developed, based on budget size, the project duration and competition rate, with four classes, Horizon 1 to Horizon 4. Research programmes categorized as Horizon 1 have substantial budgets (about US$ 1 million per year), long time frames (about nine years) and low selection rates (only about 15% of proposals funded), while Horizon 4 programmes have low budgets (US$15 000 a year), short time frames (about two years) and high success rates (about 75% of funded proposals). Today on average 39 referees are involved in evaluating Horizon 1 programmes and 12 in Horizon 4 programmes. Although KOSEF aims to reduce the number of referees to 20 and seven respectively, one of the main challenges it faces is the selection of good referees.

27. KOSEF is considering moving from the 'open model' of referee management to the 'closed model' in which referees are contracted to work for a defined period of time. The Japan Society for the Promotion of Science (JSPS) and the UK Engineering and Physical Sciences Research Council (EPSRC) are as examples of organizations using such a model. In those organizations a pool of official referees is contracted for two and three years respectively (containing about 4 800 and 4 000 referees). KOSEF also appoints a research planning and evaluation committee consisting of outside members to monitor the reviewers and advise KOSEF on how to continuously improve its review process.

28. Korean Research Foundation (KRF) is the major research funding agency for universities in Korea. In 2005 it had a budget of US $1 billion and handled 16 181 proposals (of which about a quarter were successful). From 2006 onwards, the KRF will be using a new system ('the expert driven review') to assess research proposals. Traditionally, KRF has been selecting the research grants using 'panel reviews' only. Researchers submitted their proposals through an online system (One Stop Research Management System) similar to the NSF Fast Lane. Programme managers at KRF established panels of six to nine reviewers who elect their chairperson. Each proposal was assigned to two panelists (a speaker and a discussant) who presented and discussed their assessment of the proposal to the panel. The chair and his panel gave marks to the proposals and sent a completed review form to the KRF. The funding decision was made by the Grant Selection Committee which is made up of KRF senior and mid-rank officials and officials from the Ministry of Education and Human Resources Development. The committee published a preliminary list for public comments on its homepage to prevent duplicated or overlapping supports. After a week without public complaints the funding decision became effective.

29. In contrast to this 'panel only system', the new system of an 'expert-driven review' - said to be similar to the 'mail + panel' system of the NSF in the US – will involve an assessment by three reviewers who are to be recognised scholars in the research field of the proposal. In the second step the pre-selected proposals will be reviewed by a panel organised by the programme manager.

(vi) Czech Republic

30. Finding and managing high quality referees is also a problem faced by the Czech Science Foundation. (GACR) was founded in 1993 to fund basic research in all disciplines. For the year 2005 the budget was €48.9 million and 2843 grants were awarded, of which 2145 were from the Standard Grant Scheme and the rest were grants for individual postdoctoral scholars and postdoctoral teams. It has been observed that with small national scientific communities, conflicts of interest are difficult to avoid and the related concerns of patronage and clientelism are more frequent. The GACR is addressing this problem by annually changing one third of the members of scientific committees and subcommittees (those committees oversee the review process and make recommendations on funding to the board of the foundation) and by having proposals submitted by members of those committees evaluated and ranked by a special committee. Additionally, the GACR has been using international referees from the beginning and requests that proposals be written in English. Yet it is 'getting more and more difficult to find high quality responding reviewers. About 24% of the 3585 contacted national referees in the year 2005 did not submit their reviews. The proportion among foreign referees was even higher: with 43% (of the 3673 approached) declining to take part in the review process. One solution discussed at the GACR would be to offer a financial incentive to the referees. Yet paying €50 per submitted review would increase the administrative costs of the foundation-which is currently at 2.6% of the total budget-by about 50%. Another issue was the comparability of reviews undertaken by foreign and domestic referees. An analysis of the evaluation indicated that the Czech reviewers are more likely to deliver a 'softer' evaluation than their foreign colleagues.

(vii) Turkey

31. Scientific and Technological Council of Turkey (TUBITAK) considered involving scientists from outside Turkey in its review panels to overcome what is seen as the major shortcoming of the panel system: a limited pool of reviewers and panellists. This system, used by TUBITAK since 2004, is modelled on the panel review system of the US National Science Foundation (NSF). Four notable differences are:

i) TUBITAK panel system relies more heavily on panel recommendations than the NSF panel system.

ii) TUBITAK panel system uses a more quantitative (numerical) evaluation based on a 3-dimensional evaluation scale: (a) intellectual merit, (b) broader impact, and (c) feasibility.

iii) TUBITAK panels are run by non-resident scientists and researchers unlike NSF panels which are moderated by permanent programme officers or scientists coming from academia and temporarily appointed to the NSF.

32. Funding decisions are more centralised and made at higher levels of administration, unlike NSF funding decisions that are carried out almost always by programme officers. The panel system currently operated by TUBITAK is favoured by most scientists in Turkey. A survey conducted in 2006 shows that irrespective of funding, publication records and geographical locations, researchers in Turkish universities are convinced of the efficiency of the current system. Increasing the participation of international panellists was considered to be the key means of improving the current system, not least because of the increasing number of proposals evaluated. Between 2004 and 2005 both the number of proposals evaluated and the average number of the proposals per panel doubled from 1 447 to 3 401 and from 8 to 16 respectively.

(viii) China

33. National Natural Science Foundation of China (NSFC) is the major research-funding agency in China. In recent years, it saw an annual increase of proposals of 20% (to reach 64730 proposals in 2006). The NSFC has a dozen research funding schemes with slightly different selection procedures and criteria. Yet the basic system of proposal selection typically consists of three stages. After the submission, the proposals are checked by NSCF staff and between 95 and 97% of the proposals enter the second stage of mail review. This is the most critical step involving contacting two to five experts (with 95-98% feedback from the reviewers). The programme managers critically choose the reviewers from a 60 000 record database. The reviewers have not only to be experienced experts in the given research field and be still working actively in the field and familiar with the frontier of the field in question but also 'tolerant' of different research approaches. About 30-40% of the proposals pass this step to be reviewed by one of the 60 panels of the NSFC (involving nine to 14 panellists). The review panel makes the final

decision by majority vote (mostly anonymously). The success rate lies between 15 and 25%. Each step in this selection process has its own safeguard mechanism to avoid bias. The panelists and programme managers at the NSFC are encouraged to spot 'risky project' proposals' which are then funded under stricter conditions: their duration is shorter (e.g. one year) and their budget is smaller (roughly a third or a half of the normal project budget). About 3% of the total budget is devoted to such projects.

1.10 Assessment and Selection of Research Proposals (International and Transnational)

34. Established in 1964, the European Molecular Biology Organization (EMBO) is to promote excellence in molecular life sciences in Europe. It is a membership-based organization and members are elected annually on the basis of their record in research. In 2006, EMBO had 1100 EMBO-elected members in Europe (including 38 Nobel Prize winners) and over 60 associate members globally. EMBO uses peer review in its two main activities: research funding and science publications. For both, to a large extent, EMBO uses the expertise of its members. EMBO funds, among other things, postdoctoral and long-term fellowships for outstanding scientists in life sciences. In 2005 about 200 awardees were selected from 1235 applicants. Applications for long-term fellowships are pre-screened by the members of the programme committee (with a balanced scientific, geographic and gender composition, where possible) and further evaluations and individual interviews are carried out by EMBO members and Young Investigators. Final decisions are made after discussions and individual scoring of applications.

35. A particular issue to which EMBO has paid attention is the potential bias of peer review against female applicants in its funding schemes. A pilot evaluation scheme with gender-blinding was undertaken.

36. Founded in 1971, Co-operation in the Field of Scientific and Technical cooperation (COST) is Europe's first intergovernmental European network for the coordination of nationally funded research. It has 35 member countries. It supports the cooperation efforts of European research through COST Actions. The three pillars of quality control at COST are: assessment of proposals for new Actions, monitoring of the running Actions

and final evaluation of completed Actions. Proposals for new Actions are submitted in a two-stage process: preliminary proposals can be submitted at any time and on any subject (two collection dates per year). After a formal check the proposals are prescreened and ranked according to specific criteria by COST Domain Committees involving at least eight members. Subject to the available budget for new Actions, the highest-ranked preliminary proposals are invited to submit a full proposal. Full proposals are evaluated by an External Expert Panel, which is coordinated by rapporteurs designated by the relevant COST Domain Committee (DC). Each DC establishes a ranked list of proposals and a meeting between DC chairs establishes a general ranking list with recommendations on funding. The CSO (Committee of Senior Officials), which is the highest decision-making body made up of representatives of all COST member countries, takes the final funding decisions.

37. Wellcome Trust, with a budget of about £ 450 million funds about 6000 researchers in over 50 countries. The selection of the projects is done on a peer review basis. In 2004/05, about 2500 new applications were submitted and 800 awards granted after a peer review process in which over 10000 referees were contacted. With so much effort being put into getting the proposals properly selected, the post-award evaluation at the Wellcome Trust focuses on the questions whether the right choices were made and whether some funding mechanisms are more likely to yield more important research results than others. The Wellcome Trust has used the bibliographic system Pubmed which indexes papers acknowledging the Wellcome Trust since May 2005. About 1 000 papers recorded for the period between May 2005 and September 2005, were reviewed by a 'peer review college' to assess their importance to the research community. Categorising the papers into four categories ('landmark Research', 'major addition to knowledge', 'useful step forward' and 'for the record'), the peer-review college found that around 9% of the papers can be considered at least as a 'major addition to knowledge'. It was also shown that particular funding schemes are related to 'success'; for example larger grants seem to be more prone to yielding 'more important' research. Dr Allen concluded by calling for cooperation between research-funding agencies to conduct cross-agency evaluations of this kind for benchmark purposes and to work jointly towards commonly acknowledged practices and conventions.

1.11 Transnational Research Funding Programmes

38. It is observed that peer review systems in European Nordic Countries are different, but this does not prevent the countries from working together. Under the framework of the Nordic Cooperation developed since the 1960s, national science organisations can choose activities of interest to address jointly with their counterparts in other Nordic countries. In some areas, joint research has been funded, while in other areas they worked together more on a policy level. *'It's all about identifying common concerns and being flexible in what you want to achieve together'*. When it comes to peer review, there are experiments in working closely together and in using each other's experts. The countries are small, and there is a lot of pressure on the peer review system. Everyone is 'fishing from the same pool'. There are concerns that with advent of the European Research Council (ERC), the competition for best experts to act as referees will intensify.

39. The ERANET NanoSciERA is a cooperation between 12 countries who have recently launched a joint call for proposals with a 'common pot' mechanism to fund the best projects. To combine different national practices and get to a procedure that allows everyone to participate is a very delicate and important task not only for the efficacy and efficiency of the process but also for its acceptability of the transnational process. Researchers, knowing their own home institution, project onto it the trust they have in their home agency. In developing the peer review of the NanoSciERA, the organisations involved faced two problems: to develop principles to prevent conflict of interest and to assess the level of expertise of the referees approached.

40. Regarding the conflict of interest the NanoSciERA adopted the guidelines of the Deutsche Forschungsgemeinschaft (DFG) because they had a very useful written document explicitly relating to the appearance of conflict of interest. Furthermore, panel members from outside the consortium countries were selected (on recommendation of the participating organisations). But it is still difficult as *'the best people know the best people (also from different regions of the world)'*. In order to further ensure a fair and competent assessment, the referees were asked to self-rate their expertise. Further features of the review system include a software-tool developed for referee assignment on the basis of key words and giving the applicants the opportunity to reply to referees' comments ('rebuttal'). Dr Abram concluded by saying that notwithstanding the fact that

the ERA-NET scheme may be too new to say if it will establish itself as a means of transnational collaboration, a sound peer review system is a key factor for its acceptance. In ERA-NET, evaluation and funding are closely linked. The outcome of the peer review is the distribution of funds.

41. There are currently 15 countries participating in the EURYI (European Young Investigator) scheme. The selection of the awardees (who respond to a call issued by

the ESF) is organised in two steps. The first step (S1) in selection is in the hands of national research councils and the second step (S2) is done by an international panel convened by ESF. A major challenge in establishing this selection mechanism was to ensure that the funding agencies involved follow similar processes in the first phase (S1). As different organisations have different approaches: *'It is essential to look at the commonalities and to get as close as possible'*. The participating organisations agree on the criteria to be used in the first stage: (i) for the candidate: potential and achievements, (ii) for the proposal: scientific quality and originality, (iii) for the host institution: level of excellence and commitment. They also agreed on the main lines of procedures to follow: (i) using three expert referees, (ii) sifting the institution, project onto it the trust they have in their proposals by disciplinary panels, (iii) a shortlist to be submitted to the international panel.

42. Two pillars of wisdom in Europe: on the one hand the European commission funding top level science with political as well societal relevance, on the other hand ESF or 'research council cooperation' funding top level science, curiosity-driven and entrepreneurial in its character. A strong point of the EUROCORES scheme is a generally high level of commitment and flexibility (shown by funding agencies) to make the best out of it. A weak point, however, is that expectations are systematically not met in terms of funding and in terms of rules/regulations if one or two funding bodies drop out or cannot fund all projects. This is very difficult to understand, and good communication between funding bodies and the ESF, as well as between funding bodies, ESF and scientific communities is essential.

43. Three issues are very important for acceptance of peer review results: (i) standardized procedures, (ii) common cultures, (iii) transparency and liability. In the light of this analysis there is room for improvement of the EUROCORES scheme. The procedures are rather clear but complicated (multi-step); it is not an easy task to coordinate national funding agencies and at the same time to develop quality standards for all participants across borders, a challenge that people outside Europe may find difficult to understand. Attention needs to be paid when the decision of the international review panel is not understood by the national funding organisation. It is recommended that communication be clear about financial frames so that scientists can calculate the potential for receiving funds. Communication is essential in the theme selection, in the review process, in communication to scientists about funding.

1.12 Peer Review for Evaluation of Research Institution

44. Following a general trend in the public sector, in the last decades publicly funded research institutions have witnessed a growing demand for accountability. They meet this demand by periodic assessment of their performance, carried out in most cases by external review panels.

45. Publicly funded research institutions often have multiple tasks: they perform high quality scientific research and provide infrastructure and services to other institutions. In their evaluation the review panels are expected to assess not only the quality of the research outputs but also the quality of the service provided and the management of the institutes (at the level of the whole organization and as well as at the research unit level). The central questions for the review of institutes are: are we doing the right things and are we doing the things right? The objectives of such a review are aimed at improving the quality of the research, the research management and leadership as well as the accountability. Another dimension, equally important, is the fact that the assessments of research institutions cover past performance and future plans. Confidence about the future is based on past performance. Because such assessment exercises are often seen as a burden on the management and the staff, mechanisms have to be in place to organize the assessment itself in way, which reduces the burden and ensures a smooth evaluation process and avoiding fossilization. Discussing the possible outcomes of an

evaluation, it was suggested that organizations should avoid directly coupling the results of the assessment and the funding decisions. The outcome will have an effect on the institution but this should be done in an indirect way. A buffer between the assessment and the funding is needed.

(i) France

46. IFREMER (French Research Institute for Exploitation of the Sea) aims at ensuring better knowledge, assessment, value enhancement and streamlining in the exploitation of marine resources and to improve knowledge and means to protect and restore the marine environment. In addition it creates and manages facilities of national interest (fleet) and it gathers, disseminates and enhances national and international oceanographic information. The evaluation of the research units and laboratories at IFREMER are conducted by an external expert group, on the basis of the analysis of a report of assessment and prospective written by the research unit to be evaluated and also on the basis of the conclusions of a visiting committee composed of some of the members of the expert group. The dual mandate of dealing both with excellent research and with providing a facility and services-as clearly shown in the mission of IFREMER-proved to be a real issue in the assessment. There are currently no performance indicators for such services. This was perceived as a problem. The separation of the assessment of the scientific excellence and of the service provided is crucial.

47. The French National Institute of Health and Medical Research (INSERM) aims at developing closer links between 'basic' and 'clinical research' It had a budget of about €600 million (in the year 2005) and has over 6000 scientists working in biological, medical and public health research. The evaluation is conducted by scientific committees (Commissions Scientifiques Specializes, CSS) with participation of external, also international, experts. The evolution involves three stages: site visits, ranking and interview of the unit leader.

48. Bibliometric indicators are used as a support tool for the evaluation committees. Several factors are used because each indicator taken individually would cover only one facet of the performance. At INSERM, the following indicators, among other, are considered: number papers (ISI database of the Institute for Scientific Information);

number of citations; number of Top 1% and 10% papers, number of papers per researcher, journal impact factor.

49. It is concluded that the bibliometric indicators should be used only as complementary to peer review judgment and cannot replace it. The experience at INSERM shows that introducing bibliometric indicators does not dramatically change the results of an evaluation. However, it strengthens the transparency of decisions and provides for their substantiation. It was at the same time noted that the bibliometric indicators should be used with an awareness of their advantages and limitations.

(ii) Italy

50. Italian National Institute for Nuclear Physics (INFN) is an organization dedicated to the study of the fundamental constituents of matter and conducts theoretical and experimental research in the fields of sub-nuclear, nuclear and astroparticle physics. Fundamental research in these areas requires the use of cutting-edge technologies and instrumentation, which the INFN develops both in its own laboratories and in collaboration with industry. In 2005-2006 a complete evaluation exercise of the scientific productivity was done for the first time, including a set of quantitative indicators relevant to measuring the impact of publications. Also introduced was a year-by-year monitoring of national and international comparison with other disciplines. The outcome of the INFN evaluation was positive. However, it was accepted that improvement can be achieved through measurable results; the inclusion of numerical measuring needs to be considered for the future.

(iii) Sweden

51. Introduced in 2005 and based on a principle of 'Support to Strong Research Environments' Swedish Linnaeus Grant scheme, funded from a share of block grants (institutional funding directly disbursed to the universities by the government), funds university research based on national competition between the universities. The Swedish Research Council had to develop a new peer review system adequate for this scheme. In this scheme, universities (vice-chancellors) can apply for long-term substantial financing (up to 10 years and up to € 1 million per year) in a specific research area. Large

universities can submit several applications. The universities are required to submit applications in agreement with their strategic plans, to lay down a communication strategy and policies regarding ethical issues, gender balance etc. They also have to commit to co-funding the initiatives (at least 50% co-funding is expected) but they may include already existing resources in the co-funding.

52. The assessment criteria focus on scientific quality attained and the potential for scientific renewal. The level of commitment of the applicant university is also taken into consideration. The selection is made by international panels: four subject-oriented panels and one general expert panel, which also takes the final decisions. Only foreign reviewers participate in the evaluations and decisions to avoid conflicts of interest as all Swedish universities are participating in the competition.

(iv) Spain

53. Spanish Council for Scientific Research (CSIC) is the largest public institution in Spain devoted to multidisciplinary scientific and technological research in all research domains. It has a budget of about €600 million (in the year 2005) and employs about 2500 research staff and 4 500 postgraduate students and postdoctoral scholars. It is organised into 116 institutes and 134 associated units collaborating with universities and other research institutions. For the development of the CSIC multi-annual strategic plan for the period 2006-09, institutes were asked to draw up their own Strategic Plan. Proposals which were assessed by external peer review panels organized along disciplinary lines (20 in all). Panel members were appointed by the CSIC upon nominations by the European Science Foundation (ESF) and the European Molecular Biology Organization (EMBO). The evaluation took into consideration the whole capacity of each institution and assessment dimensions were:

(i) Mission, vision and strategy of institutes
(ii) Research quality
(iii) Manpower and resources
(iv) Present and future organisation of institutes and research perspectives.

G – OBSERVATIONS

G1 – G2

(G) OBSERVATIONS

G1. This chapter includes observations as drown from the various materials collected on the subject.

1. Study of the Contents listed herein before may draw some very important and pertinent observations on the subject of peer review and its transparency, need for it in R&D funding and reforms called for in the system on continuous and innovative basis, looking into some aspects of the system failure on the adopted method of review.

2. The technique of peer review may also be used to improve government policy as a tool in the Open Method of Coordination of policies in the field of employmental social inclusion.

3. The effectiveness of peer review depends, upon the combination of a number of factors such as value sharing, adequate level of commitment, mutual trust and credibility. Peer review can create a catalyst for performance enhancement which can be far-reaching and open-ended.

4. Many of us find professional peer review very useful: it suggests different perspectives and provides valuable feedback on what is compelling and what is problematic in a manuscript.

5. Peer review system continues to receive widespread support in respect of grant awards. As with publications, there seems to be no alternative to reliance upon peer review as a process integral to the maintenance of quality. There is an inevitable element of independent judgement in peer review and hence has to be welcomed.

6. Appropriate peer review is seen as requirement of the R&D approval process. Information on the peer review undertaken for a study can be held in the R&D Office Research Projects database to be in used in audit/monitoring of studies, covered by a separate policy.

7. Peer review processes in Canada to ensure the optimal utilisation of research funds are clearly outlined. Mechanisms are reported to use funds efficiently, simultaneously encouraging scientific thinking and methodology in researchers.

8. It is found to be advisable to link the Open Method of Co-ordination (OMC) peer review activities with the peer reviews of national policy mixes.

9. Reviews of the use of peer review by the US Federal government reveals that its role and jurisdiction continues to expand. It is taking hold as a means of evaluating larger aspects of the R&D system and of producing relevant and reliable knowledge in the regulatory process in the Federal Court system and even in R&D funding and regulation by states.

10. AICPA, Task Force believe that by implementing its recommendations, peer review can appropriately serve the needs of users of peer review information in a transparent environment. It supports the principle of greater transparency in the reporting of peer review results.

11. Comparative Study of few responses received to questionnaire on the subject indicate the importance of peer review in R&D funding and its transparency. Transparent results also help in better dissemination to those concerned for adoption by them.

12. As part of its ongoing dialogue and co-operation with Southeast Asian countries, the OECD stands ready to continue both to help policy makers in their reform initiatives at national level and to contribute its experience with peer reviews in support of regional integration efforts.

13. There are few obvious improvements which could be made to the present system. These are related to greater emphasis on productivity, signing of reviews, introduction of appeal system and also failure reporting.

G2 Observations / suggestions at Interactive Meet by experts are found to be useful and also provide sufficient material for further thought.

Dr. Satyanarayana, ICMR: He suggested that 'History of peer Review' could be a useful addition in this report. (As suggested this aspect has been briefly covered in Annexure V) He pointed out that in 1967 Stephan Cole had made a beginning which was followed by National Science Foundation. He also referred to the way Nobel Prizes are awarded and as a third example, he mentioned about the Award system in the Princeton University. In the context of the historical background he suggested to have a close look at the National Institute of Health website and their system. He said that the success ratio is only 10%. He felt the success ratio could be an indicator of the competitiveness of the grant.

He also mentioned that there is a shortage of peers in our country. A peer review database would be useful. Since they are asked to work in an honorary / voluntary capacity they do delay and the peer review process thus gets delayed. To other points which he wanted to make referred to central mechanism relating to peer database and identify unfair practices and identify the black sheep of peers. There should be, thus a strong over sight body which can do this. The second point was relating to setting up an office of Research Integrity. This will enable to spread the correct message and improve the system.

Mr. Abhayankar: He started observing that the S&T has a clean chit in the eyes of the auditors. He wondered how we can choose a peer. What is the criteria for a peer and should it not be related to the project criteria? The prevalent practices in a peer review should be kept in view for the future. He mentioned that technically the same peers are asked to review diverse subjects. Regarding the recipient in the industry, DSIR now follows that a recognisation by the DSIR is a precondition. This is helpful because the basic data about such an organization is readily available and would enable to avoid risks to a certain extent.

At the request of DRDO and DAE, he mentioned their experience in funding industrial projects. Basically they have a legal agreement for such projects. He was willing to share the agreements with anyone who may be interested. He also referred to using NRDC as

an arm for collecting payments where due, from the industrial units. He mentioned that annually NRDC is now able to collect about Rs. 3 crores on the basis of payment of 2% royalty. This would mean that the industrial production arising from their funding is of the order of Rs. 150 crore per year. He mentioned that DSIR would have funded over 250 projects and their experience as a whole is satisfactory even though in a few cases the industry has tried to get the upper hand to avoid payments.

Dr. Hedge – CPRI: He mentioned about the practice in CPRI. They start with the selection of a project and judge whether it will provide tangible benefits. This is done before the initiation of providing a sanction. Regarding honorarium, normally the TA/DA relating to expenditure of the peer is completely borne by the organization. There is a reluctance to pay additional cash honorarium. The World Bank and other UN Committees are generous in paying adequate honorarium with the result they do thorough job and also do not delay sending their reports. Regarding the cost cutting, he said when their grants are paid in stages and periodical review enables them to limit the funding and to avoid wastages.

Dr. V Kain – Deptt. Of Atomic Anergy: They have internal peer review teams. He said their funding schemes are implemented after the topics are identified. They prefer a collaborative project. They have four main areas in which they have Advisory Committees. They are anxious to identify key persons in a project. Currently, instead of somebody applying for a project, DAE after having identified the project will go to an agency who can execute them. He stressed the importance of spreading information and creating awareness about their schemes. Reform can be done by providing rating on the qualities of the applicants by Peer Review team to applicants.

They have several layers of processing in their BRNS (Board of Research in Nuclear Sciences). A multi – layer review through Advisory committees almost start with being vetted by a collaborator in the department. Technically the department may ask for presentation and assess their internal values. In this often they have an open forum in which the interested members of their department from any of their units can attend and give the comments. In their TPDM (Technical Programme Discussion Meeting), atleast one expert will have to be from outside. Projects costing over Rs. 20-30 Lakhs have to go

to their Board which consists of different organizations in the country. Some programmes cost even Rs. 5 crores and here more than one agency could be involved in the funding. He pointed out that they have thematic sub-committees. They consist of atleast 10 members. Once the sanction is issued there will be regular reviews. During this mid-term corrections are made.

Dr. Ashok Mohan: He added a few points confirming the views of the DAE. He said there are 8 major committees which are of direct relevance to DAE. On the issue of over-work of peers, he recognized the problem but said that this also some times is a factor contributing to the strength of their contribution. He suggested that "D" portion of the draft report can be reviewed. He further suggested that chapter on Observations and Conclusions and Recommendations should be fine-tuned in the context of observations at the interaction meeting. (This has been appropriately dealt with in this Report).

Dr. Sankaran: Dr Sankaran mentioned their funding can be grouped into two groups – one extramural and the others approved through their Research Boards. In fact there are more than 50 areas of the research boards. Before the sanctions are issued the discussion could result in the Project Investigator being asked to make certain modifications. Mid course correction is particularly rigorous for long-term projects. Normally they cost Rs. 10-50 Lakhs and upto 75% of these go to DRDO. High costs projects of Rs. 1 crore or more normally involve entering into a Memorandum of Understanding involving the Project advisory Committee and the Chief Controller of Research. They have Research Board, particularly based on thematic areas. These include involvement of representatives from Navy, Army and Air Force. Their projects go to the Board for the decision. In addition they are keen on obtaining technical results having importance to their objectives. They have periodical review. Often they will not have recommendations for closing the project partly because of their concern for audit objections. Mid-term corrections involve generally extension of time for the projects.

Department of IT – Mr. Taneja: He pointed out financial readjustments are not common', delays on timeliness is frowned upon, closures do not normally happen.

Success rate in their funding industries is not very satisfactory. They would like to know more about this from DSIR. In the context of international projects, they benefit from the review mechanism which are very strong and timely. When several streams of subjects are involved they resort to a consortium approach but they do identify a lead person. These lead persons normally continue through the life cycle of the project. They also fund educational program but they consider this as any other project. They are not funding for industrial projects because of their bad experience in the past. They are concerned with duplication of funding from time to time.

DBT - Dr. Gulshan Wadhwa and Dr Linga Raju: They wanted to comment on the report and then give their practices. They appreciated the practices highlighted in the report. They felt some processes slow down decision making and the report indicates some measures to speed them up. Normally, most of the steps suggested in the report are followed but most of the communication is invariably through email. The report as a whole is very valuable and contains information on most of the methods under the subject.

Regarding the processes in the DBT, they have a three tier system. In the first phase it is an internal assessment. Here they decide whether there is any novelty in the programme and whether the agency is capable of doing this work. At this stage they register the project and give a number. In the second stage they seek peer recommendations and normally they choose five peers. Projects must be recommended at least by three for progressing further. The third tier is a Task Force level in which a committee examines and arrives on a final decision to support or otherwise. Cost cutting of the project is done before being presented to the Task Force. In case of genetically modified organisms, they should get a favourable recommendation from Bio-safety Group. Special projects relating to Bio-informatics take full advantage of the software they have developed for rapid communication among the concerned.

MOEF - Dr Naseer Ahmad and Dr H Kharakwal: They have identified some 22 thrust areas and the committee after approval is very particular about mid-course corrections. They suggested payment of an honorarium to the peers to expedite their response to the clearance.

Proposals received in the Ministry are initially screened by the expert group and rejected if the project does not have substance or the outcome of the project is not going to add any thing new. Otherwise it is referred to Peer Reviewers for comments. Final appraisal is done be Thematic Peer Group. Transparency should be to the limited extent. In case with some proposed suggestion the project can be revised, the comments may be sent to PI for revision. But this should be done in a limited manner, not in all cases.

Dr. Laxman Prasad: Dr Laxman Prasad briefly narrated the DST experience. He said there were special cases in which the Committee has approved a project even when all the peer members have recommended rejection. Equally on the other side, even where the peers have unanimously recommended approval the committee have rejected them. Thus, the peer review serves only as an input mechanism but not a guarantee for a favourable decision. He also mentioned about mid-course corrections and if the committee recommends enhancement of the project cost, they are normally accepted. The closure of projects are very rare though it has happened in a very small number of cases. Briefly, cost cutting is not a serious problem. He also mentioned that the comments and recommendations of the peer are passed on to the Investigator but their names are not revealed. This may be a controversial point and debatable.

Mr N K Sharma: He suggested that he has worked as a peer for several agencies and in India Rs. 7,500-10,000 is normally paid for their work. The project from Europe provides Euros 2000 for a valuation. He said we should ensure the appropriate payments to ensure timely and fair assessment. Project cost should be basis for adopting selective yard sticks.

Regarding the cost of valuation Vis-à-vis the cost of the project, there should be some norms. Perhaps, 1-2 ½% for preliminary valuation and an equal amount for valuation during the progress of the project appear to be a reasonable norm. Criteria for peers should be evolved, but it could be different for different subject areas. Site visit are often useful to assess the correct position.

AYSUH - Dr Manoj Nasari & Dr S. N. Sahu: Procedure adopted for peer review is different for different kinds of schemes. The reprehensive from AYUSH regretted that in

many cases the peer review leads to encroachment of IPR. Some peers also hijack the project and later seek funding from different agencies for the same ideas. He also commented that there are several agencies who deal with herbal plants and some agencies manage to get support because of the incompetence of the funding agency. There should be a national policy to display the peer reviewed research projects, which can be classified under different heads.

Dr. Dhar: He pointed out that substantial part of the funding still comes from the Government and as such certain procedural formalities are inescapable. He also referred to similar type of criteria being adopted for basic science projects and engineering projects. This needs to be corrected. He recalled the observation of Dr. Laxman Prasad that it is the person who wears the shoe knows where it pinches and in this context some of the agencies are not getting projects at all. Same agencies get projects again and again. He also referred to the need for young scientists to be more and more involved. He also recommended the need for referees to be suitably paid. At one time the referees were considered to be honorary and free from having any commercial interest, but this is not always the situation now. It has very much changed now because of involvement of big amounts.

Mr Johry: Mr. Johry mentioned about the way PL480 funds were disbursed. He recalled the efforts made to fund the projects adequately and in a reasonable time.

Ms. S. A. Panda: Ms. Panda of the office of Comptroller & Auditor General of India observed that their audit normally views a project from two angles: (i) the transaction issue and (ii) the performance factors. She said that if a research Advisory Committee has recommended increase in cost they have accepted the same. Audit tries to be fair to scientific departments similarly, they have also recognized the difference in the projects for basic and applied research. She expressed concern relating to diversity of projects namely the same project being done again and again or submitted to different agencies from time to time. This needed some coordination to prevent such double payment on the same project. Their audit is focused substantially with respect to the bench marks. They are very anxious and often do convey the best practices in certain agencies to other so that good practices are used more and more. It is suggested that peer review be broadly

standardized in order to also enable Audit to evaluate the performances, both financial and scientific in scientific Organizations.

Prof. S. K. Joshi – NPL Delhi – He suggested specific modifications in the letters which DST sends to referees for reviewing a proposal. (Since these are individually and separately handled by various Science and Engineering Councils these may be suitably modified by the senders based on our report wherever appropriate).

H - CONCLUSIONS

(H) - CONCLUSIONS

1.1 Identified Issues

(i) The broad Mission:

14. The research institutions / scientific institutions, be they universities or research institutes, have a broader mission than just research. Assessments of their performance should therefore take into account the quality of projects (excellence) but should also consider societal needs. In the case of universities there is a need for regional/societal access to high quality higher education. A possible way to accommodate potentially conflicting needs could be a combination of different streams of funding ensuring support for excellence in research and for other types of performance important for society (teaching, continuing education, technology transfer). For example, the Linnaeus Grants in Sweden are only one of several streams of funding for universities. They are awarded solely on the research excellence principle while other funding sources ensure regional coverage of higher education institutions. In the case of research institutes, other missions such as providing access to research infrastructures and services e.g. IFREMER, should also be taken into consideration.

(ii) The long-term perspective:

15. Research institutions, unlike most individual research projects, operate on a long-term basis. Their reviews should take into consideration the need for stability of funding for the institutions both to ensure the development of a given research area and to secure the professional careers of researchers.

(iii) The scope of evaluation:

16. Distinct from the evaluation of research grant applications that concentrate on the scientific quality of a proposal, the evaluation of institutions must find a balance between looking back and presenting daring new activities. In the case of Linnaeus Grants, universities were competing on the basis of the attained scientific quality (state-of-the-art) and potential for development (future strategy). The same approach was used for assessing strategic plans of CSIC institutes where future strategies were based on past achievements. In the INSERM team evaluation exercise, bibliometric indicators were

used as a complementary tool in the assessment of up to date achievements of research teams, which in turn were treated as a prognosis of future achievements. The assessments are thus facing a difficult task: to be both retrospective and prospective.

(iv) Internationalization of review panels:

17. Very often, because a national system of institutions which undergoes evaluation involves a large part of the research community of a given country, there is a need to widely use international peers. Increasingly, international peers were being invited to be part of the review panels: Linnaeus Grants where only foreign peers were assessing proposals and making decisions, CSIC evaluation where a substantial number of reviewers from outside Spain were invited, the evaluation of the Italian National Institute of Nuclear Physics where an international evaluation committee was appointed.

(v) Information technology:

18. it is found that information systems and databases give access to a very wide, international pool of experts and, helping to identify the best expertise for a given case and enhance the quality of the peer review. Another area in which information technology may help in the evaluation of research institutions is its potential to reduce the burden of evaluation exercises put onto researchers.

1.2 Science Policy Context for Excellent Peer Review

19. The diversity of the approaches with regard to the practical organisation of peer review is matched by the wide range of the areas in which it is used. In the context of research institutions the peer review is used to judge the promise of a research grant/grantee; to assess the progress of on-going research programmes and to retrospectively rate the quality of the outputs of funded research.

Experts try to look at the context in which it operates;

a) Are strategic visions being sufficiently taken into account by current peer review mechanisms?
b) What are the challenges it faces, where do they come from and are they being met?
c) Are there possible alternatives in allocating research funding?

20. Experts of European Science Foundation challenge the presumption of peer review that any reasonable panel will come out with the same result with respect to excellence, and argued that the results are actually dependent on prior assumptions which should be made transparent before the review. The importance of supporting innovative frontier science and the difficulties encountered in the current climate of tight budgets and timelines need attention. The use of a 'Roadmap' and financial spreadsheets is seen as a powerful aid for peer review panels in making strategic decisions. Peer review needs a science policy context and iterative processes to achieve excellence; scientific quality and science policy have to be coupled. The challenge for the future is to overcome the risk-averse funding culture in Europe and the so called 'tyranny of peer review' decisions based on past investments, big laboratories and/or conservatism.

21. Innovative research is confronted with bias, conservatism and politics; from an economist's perspective, peer review can be seen as an economic market, where there is a struggle for power: scientific authority versus social capital. It is imperative to consider innovation as the key driver of economic performance and to include the socio-economic impact of innovation in the evaluation criteria. Knowledge transfer is currently a less visible driver but it should be considered a main evaluation output. New techniques and the so called 'ICT push' supply additional pressures to the peer review system. These are 'healthy' pressures because they lead to improvements and increase the quality of the peer review process. The evaluation industry is pushing for more evaluations, including analyses of cost-benefit ratios, surveys and bibliometrics; unfortunately, evaluation is too often reduced to mere techniques rather than the use that can be made of it.

22. Several strategies modify or partly replace peer review in scientific selection processes. It is however observed that peer review is not replaceable by any of the suggested strategies but that a search for alternatives or mechanisms to improve it should be continued.

1.3 Key Questions

23. Contents of the foregoing report address the three key questions:

I. Is peer review in the present form able to identify the best and most innovative frontier science and how might it be improved?

The scientific landscape has changed under the influence of the European Research Area, the overall globalisation and the move in research towards multidisciplinarity. Nevertheless the peer review system has remained virtually the same. Since it is concluded that there are no real alternatives to peer review there is a need to improve the system and look at the system in a different way. It is recognized that the system is not flawless. There is a need to pay more attention to innovative frontier science which is often high-risk research. Several highly important innovative developments in research may be rejected because of conservative views within the system. It has been mentioned that there is no place for conservatism in the peer review system. Specificities in the use of peer review for evaluation of institutions were pointed out. In reviewing the performance of institutions, not only their attained scientific quality but also the potential to realise strategic development must be considered. Furthermore, although undoubtedly scientific excellence is the most important goal of the institution also societal concerns for equity and fairness must be taken into account when evaluating science institutions.

II What is the best way to harmonise the peer review process and how can new methods and IT tools contribute to it?

Instruments such as EUROCORES and EURYI have contributed to the harmonization of the peer review process at the European level. The close cooperation between the Scandinavian countries has also led to more harmonization of the process. Nevertheless lack of harmonization remains a difficult hurdle to overcome because of differences in the scientific traditions and research systems between various countries. However, the increasing use of international referees creates a need for more harmonization (e.g. using English as the language of science). Efforts are needed to try to harmonise procedures

and practices both in peer review and in the evaluation of institutions. Another area which may need further exploration is the education of reviewers in the tasks they are expected to do and the professionalisation of science management. The potential increase in R&D funding in Europe will put new burdens on officers of the funding agencies and research councils. Their high professionalism will play an essential role in the future quality of the peer review process in Europe.

Guidelines for a minimum set of standards should be developed (e.g. in EuroHORCs and/or ESF) in order to 'find one another' in a European procedure and ensure trust and liability. Grant agencies, research councils and other bodies distributing money for research on the basis of peer review in Europe should collaborate more closely, e.g. by sharing their databases of reviewers. Furthermore, organisations should try to use each other's review panels. A most desirable approach, mentioned several times, was the creation of a common pool of reviewers in Europe. As an initiative to discuss possible cooperation between European research organisations the ESF Member Forum on Peer Review was announced. Electronic tools must be used widely, especially in cases where referees come from all over the world. They can also be used in the effort to coordinate reviewers' inputs, set up meetings, sharing databases, etc. It is expected that many of the activities of peer reviewers connected with travelling will be replaced in the future by electronic platforms such as teleconferences, videoenhanced discussions and secure Internet discussion boards.

III. What are the major societal, cultural and ethical challenges of future peer review processes and how could they be incorporated?

It was recognised that each country has its own specificities also regarding peer review. In some countries it is common practice that a lot of emphasis is put on the status of the applicant while in other countries the focus is more on the application itself. The question of remuneration of referees was mentioned in several contributions. No standard approach exists among funding agencies. Another issue is the difference between domestic and foreign reviewers. In some countries domestic reviewers are seen as 'stricter', in others their view seems 'more soft' than that of the foreign reviewers. About the 'best reviewers' it was pointed out that 'best reviewers' must not only be excellent in their field but also

Further avoiding any conflict of interest is the cornerstone of any effective peer review process. Therefore a set of guidelines or protocol to tackle them should be developed. There are several guidelines already existing in different funding agencies and research councils that can be followed. In addition, there is the misjudgment of referees. It is not possible to avoid this in all cases. Referees are people and people tend to make mistakes. In efforts to assure a fairer judgment of proposals, some agencies ask the referees to self-rate their expertise. Examples of software being used to assign proposals to referees on the basis of key words were mentioned as well as the introduction of possibilities for 'rebuttal' from applicants.

Recently, serious ethical problems have appeared in the publication of results of research in scientific journals. Several cases of fraud, fabrication and falsification of data have led publishers, editorial boards and ethical committees of scientific institutions to strengthen the peer review process. Yet the main responsibility for investigating allegations lies with the institutions and funding agencies that pay for the work. In a number of research fields, notably in biomedicine, science journals have started to experiment with an open peer review system. Instead of using traditional blind peer review, they publish reviewer's reports (thus making the names of reviewers public). All the above mentioned aspects and problems of the contemporary peer review need a strategic evaluation at a more conceptual level, not of a specific mechanism, but of the underlying principles and ideas.

Foregoing observations and conclusions on various prevalent issues are equally applicable in Indian context also and hence continuously monitoring the peer review system on which the quality of science so heavily depends will contribute to its improvement. Some of the important suggestions amenating from Interactive Meet are (i) setting up of an office of Research Integrity, (ii) basing the selection of project on its tangible benefits, (iii) providing rating on the qualities of the applicants by Peer Reviewers (iv) payment of honorarium to the peers to expedite their response, (v) practice of adoption of similar type of criteria for basic science projects needs to be corrected and also, (vi) some amount of standardization from audit point of view to evaluate financial and scientific evaluations.

ANNEXURES

Annexure I	**:**	**Hwang Woo-Suk-Discredited Scientist**
Annexure II	**:**	**Parliamentary Office of Science and Technology Peer Review – UK**
Annexure III	**:**	**EU 7th Research Framework Programme (FP7)**
Annexure IV	**:**	**List of Participants**
Annexure V	**:**	**History of Peer Review**

Annexure – I

Hwang Woo-Suk – Discredited Scientist

Hwang Woo-Suk is a South Korean biomedical scientist. He was a professor of theriogenology and biotechnology at Seoul National University (dismissed on March 20, 2006) who rose to fame after claiming a series of remarkable breakthroughs in the field of stem cell research. Until November 2005, he was considered one of the pioneering experts in the field of stem cell research, best known for two articles published in the journal *Science* in 2004 and 2005 where he fraudulently reported to have succeeded in creating human embryonic stem cells by cloning. Both papers were later editorially retracted after they were found to contain a large amount of fabricated data. He has admitted to various lies and frauds.

On May 12, 2006, Hwang was "indicted on embezzlement and bioethics law violations linked to faked stem cell research." Korea Times reported on June 10, 2007 that "The University expelled him and the government rescinded its financial and legal support. While being charged with fraud and embezzlement, he has kept a low profile at the Suam Bioengineering Research Institute in Yongin, Gyeonggi Province, where he is officially engaged in animal cloning. The government barred Hwang from conducting human cloning research.

Life

Hwang grew up in the central Korean province of South Chungcheong. He worked at a farm to finance his studies when his widowed mother could not earn enough to provide for him and five other siblings. Hwang matriculated at the prestigious Seoul National University after graduating from Daejeon high school. It was later revealed that despite his professors urging that he become a medical doctor, Hwang chose to be a veterinarian. After earning his doctorate, Hwang briefly practiced veterinary medicine, before moving into the field of scientific research. His aim, then, was to create a genetically superior Korean cow. Eventually, he became a full-time researcher at his alma mater, Seoul National University. Every day, he would turn up at the laboratory at 6 AM and leave at midnight.

Hwang first caught media attention in South Korea when he announced he successfully created a cloned dairy cow, *Yeongrong-i* in February 1999. His alleged success was touted as the fifth instance in the world in cow cloning, with a notable caveat: Hwang failed to provide scientifically verifiable data for the research, giving only media sessions and photo-ops. Hwang's next claim came only two months later in April 1999, when he announced the cloning of a Korean cow, *Jin-i,* also without providing any scientifically verifiable data. Despite the notable absence of any of the scientific data needed to probe the validity of the research, Hwang's several claims were well received by the South Korean media and public, who were attracted by Hwang's claim of immeasurable economic prospect that his research was said to be promising. Until 2004, Hwang's main area of research remained in creating genetically-modified livestock that included cows and pigs. During that period, Hwang claimed to have created a BSE-resistant cow, which hasn't been verified yet, and he also claimed that he will clone a Siberian tiger sometime soon, a promise that hasn't been fulfilled.

In February 2004, Hwang and his team announced that they had successfully created an embryonic stem cell with the somatic cell nuclear transfer method, and published their paper in the March 12 issue of *Science*. Although Hwang had already established himself as an expert in animal cloning and secured celebrity status in South Korea in the late 90s, his alleged sudden success came as a surprise because this was the first reported success in human somatic cell cloning. Until Hwang's claim, it was generally agreed that creating a human stem cell by cloning was next to impossible due to the complexity of primates. Hwang explained that his team used 242 eggs to create a single cell line.

Hwang's team announced an even greater achievement a year later in May 2005, and claimed they had created 11 human embryonic stem cells using 185 eggs. His work, published in the June 17 issue of *Science*, was instantly hailed as a breakthrough in biotechnology because the cells were allegedly created with somatic cells from patients of different age and gender, while the stem cell of 2004 was created with eggs and somatic cells from a single female donor. This meant every patient could receive custom-made treatment with no immune reactions. In addition, Hwang's claim meant that his team had boosted their success rate by 14 times and that this technology could be medically viable.

Following on the alleged earlier success, on August 3, 2005, Hwang announced that his team of researchers had become the first team to successfully clone a dog. The dog, an Afghan Hound, was named *Snuppy*. Shortly after his so-called groundbreaking 2005 work, Hwang was appointed to head the new World Stem Cell Hub, a facility that was to be the world's leading stem cell research centre. However, in November 2005, Gerald Schatten, a University of Pittsburgh researcher who had worked with Hwang for two years, made the surprise announcement that he had ceased his collaboration with Hwang. In an interview, Schatten commented that "my decision is grounded solely on concerns regarding oocyte (egg) donations in Hwang's research reported in 2004." Following an intense media probe, Roh Sung-il, one of Hwang's close collaborators and head of *MizMedi Women's Hospital*, held a news conference on November 21. During the conference Roh admitted that he had paid women US$1,400 each for donating their eggs, eggs that were later used in Hwang's research. However, Roh claimed Hwang was unaware of this, while the South Korean Ministry of Health assured that no laws or ethical guidelines had been breached as there were no commercial interests involved in this payout. Hwang maintained that he was unaware that these actions were happening during the research and he resigned from his post..

On November 22, *"PD Su-cheop"*, a popular MBC investigative reporting show, raised the possibility of unethical conduct in the egg cell acquiring process. Despite the factual accuracy of the report, news media as well as people caught up in nationalistic fervor in their unwavering support for Hwang asserted that criticism of Hwang's work was *"unpatriotic,"* so much so that the major companies who were sponsoring the show immediately withdrew their support. On November 24, Hwang held a press conference in Seoul, in which he declared his intention of resigning from most of his official posts. He also apologized for his actions. In the interview he said, *"I was blinded by work and my drive for achievement."* He denied coercing his researchers into donating eggs and claimed that he found out about the situation only after it had occurred. He added that he had lied about the source of the eggs donated to protect the privacy of his female researchers, and that he was not aware of the Declaration of Helsinki, which clearly enumerates his actions as a breach of ethical conduct. After the press conference, which was aired on all major South Korean television networks, most of the nation's media outlets, government ministries, and the public gave support to Hwang. Sympathy for Hwang outpoured, resulting in an increase in the number of women who wanted to

donate their eggs for Hwang's research. On December 29, 2005, the university determined that all 11 of Hwang's stem cell lines were fabricated. The university announced on January 10, 2006 that Hwang's 2004 and 2005 papers on *Science* were both fabricated. Following on the confirmation of scientific misconduct, on January 11, *Science* retracted both of Hwang's papers on unconditional terms.

On January 12, 2006 Hwang held a press conference to apologize for the entire fiasco, but still did not admit to cheating. Instead, he explicitly put the blame on other members of his research project for having deceived him with false data and alleged a conspiracy, saying that his projects had been sabotaged and that there was theft of materials involved. He said that cloning human stem cells was possible and that he had the technology to do it, and if he were given six more months he could prove it. This is an extension of the *"ten days"* he said he needed to re-create the stem cells that he asked for back on December 16, 2005. Seoul prosecutors raided his home that day for files and evidence, to start a *"criminal investigation"* of Hwang. On January 20, 2006 Hwang maintained that two of his 11 forged stem cell lines had been maliciously switched for cells from regular, not cloned, embryos. The allegation involves the lines Hwang claims to have created at Seoul-based MizMedi Hospital.

Controversies

Until late November 2005, Hwang was criticized only for unpublicized ethical violations. Colleagues and media outlets asserted that he had paid female donors for egg donations and that he had received donations from two junior researchers, both of which were violations. Later controversies would center around scientific misconduct. His team who cloned the first human embryo to use for research said they have used the same technology to create batches of embryonic stem cells from nine patients. According to Hwang, the result was much more efficient than they had hoped. Hwang's integrity as a researcher was again put in doubt when it was revealed that *"PD Su-cheop"* scheduled a follow-up report questioning his achievement published in *Science* in June 2005, which stated he had cloned 11 lines of embryonic stem cells. This caused furious backlash in the South Korean people, and the reaction only intensified when it was discovered that Kim Sun-Jong, one of Hwang's researchers from MizMedi, was coerced by illegal means to testify against Hwang. As a result, the scheduled broadcast was canceled and the

network even made a public apology to the nation, everyone more or less operating under the assumption that the show was at fault and not Hwang. Yet, other news outlets began to question Hwang's claims.

The scandal took a dramatic turn on December 15, when Roh Sung-il, who collaborated on that paper, stated to media outlets that nine of those eleven lines had been faked; specifically, DNA tests illustrated that those nine lines shared identical DNA, implying that they had come from the same source. Roh stated that *"Professor Hwang admitted to fabrication,"* and that he, Hwang, and another coauthor had asked *Science* to withdraw the paper. Adding fuel to the fire, MBC broadcasted the content of the canceled *PD Su-cheop* show, which substantiated Roh's claim. On the same day, ABC news reported that *Science* had not yet received an official request from Hwang to withdraw the paper, and it had refused to remove Schatten's name from the paper, stating, *"No single author, having declared at the time of submission his full and complete confidence in the contents of the paper, can retract his name unilaterally, after publication."*

Public opinion appears to be that Hwang was dancing around the issue of whether his work was faked or not.

Some scientists have started questioning Hwang's earlier work published in *Science* in February 2004 in which he claimed to have cloned embryonic stem cells. Maria Biotech head Park Se-pill said, ``Up until now, I have believed Hwang did derive cloned embryonic stem cells although he admitted to misconduct in his follow-up paper on patient-specific stem cells...Now, I am not sure whether the cloned stem cell really existed.'' On July 26, 2006, Hwang said in testimony that he spent part of 500 million won in private donations in attempts to clone extinct Russian mammoths and Korean tigers.

Official probe by Seoul National University and the confirmation of fraud

An internal panel was set up in Seoul National University to investigate the allegation, and the probe was started on December 17, 2005. The panel sealed off Hwang's laboratory and conducted a thorough investigation, collecting testimonies from Hwang, Guang Gao, Roh and other people that were involved with the scandal. On December 23, the panel announced its initial finding that Hwang had intentionally

fabricated stem cell research results creating nine fake cell lines out of eleven, and added that the validity of two remaining cell lines is yet to be confirmed. The panel stated that Hwang's misconduct is *"a grave act damaging the foundation of science."* Hwang's claim of having used only 185 eggs to create stem cell lines was also denied by the panel, which indicated that more eggs may have been used in the research process. The panel announced additional findings on December 29, and confirmed that there are no patient-matched embryonic stem cells in existence and that Hwang's team doesn't have the scientific data to prove any of the stem cells have ever been made.

In its final report published on January 10, 2006, the panel reaffirmed its previous findings while announcing additional discoveries. The panel found out that, contrary to Hwang's claim of having used 185 eggs for his team's 2005 paper, at least 273 eggs were shown to have been used according to research records kept in Hwang's lab. In addition, the panel discovered that Hwang's team was supplied with 2,061 eggs in the period of November 28, 2002 to December 8, 2005. Hwang's claim of not having known about the donation of eggs by his own female researchers was also denied by the panel; in fact, it was discovered that Hwang himself had distributed egg donation consent forms to his researchers and personally escorted one to the MizMedi Hospital to take the egg extraction procedure. The panel stated that Hwang's 2004 Science paper was also fabricated and decided the stem cell discussed in the paper may have been generated by a case of parthenogenetic process. Although Hwang's team didn't rule out the possibility of parthenogenetic process in the paper, the panel said, his team didn't make any conscientious effort to probe the possibility through the tests available.

On February 9, 2006, the university suspended Hwang's position as the university's professor, together with six other faculty members who participated in Hwang's team. Subsequently, Hwang was dismissed from the university on March 20, 2006. On May 12, 2006, Hwang was indicted on charges of fraud, embezzlement and breach of the country's bioethics law, without physical detention. Prosecutors also brought fraud charges against the three stem cell researchers. He embezzled 2.8 billion won ($3 million) out of some 40 billion won in research funds for personal purposes and the illegal purchase of ova used in his experiments.

Parthenogenesis

On August 2, 2007, after much independent investigation, it was revealed that Hwang's team succeeded in extracting cells from eggs that had undergone parthenogenesis. Hwang claimed he and his team had extracted stem cells from cloned human embryos, however further examination of the cells' chromosomes show the same indicators of parthenogenesis in those extracted stem cells as are found in the mice created by Tokyo scientists in 2004. Although Hwang deceived the world about being the first to create artificially cloned human embryos, he did contribute a major breakthrough to the field of stem cell research. The process may offer a way for creating stem cells that are genetically matched to a particular woman for the treatment of degenerative diseases.

The news of the breakthrough came just a month after an announcement from the International Stem Cell Corporation (ISC), a California based stem cell research company, that they had successfully created the first human embryos through parthenogenesis. Although the actual results of Hwang's work were just discovered, those embryos were created by him and his team before February 2004, when the fabricated cloning results were announced, which would make them the first to successfully perform the process. Jeffrey Janus, president and director of research for ISC, agrees that "Dr. Hwang's cells have characteristics found in parthenogenetic cells" but remains cautious, saying "it needs more study."

Response to controversies

After having acquired a celebrity status in South Korea, Hwang actively sought to establish every possible tie to political and economic institutions in the country. Hwang especially tried to win favor from the Roh Moo-hyun government, which in turn was suffering from a lack of popular support and wanted to demonstrate its competency by creating and promoting an exemplary policy success. Hwang approached Park Ki-young, a former biology professor, then appointed as the Information, Science and Technology Advisor for the President, and put her as one of the co-authors in his 2004 Science paper. Ties with Park yielded a favorable environment for Hwang in the government, as a non-official group consisting of high-ranking government officials was created to support

Hwang's research that includes not only Hwang and Park, but also Kim Byung-joon, *Chief National Policy Secretary*, and Jin Dae-je, *Information and Communications minister*.

After Hwang's paper was published in Science in 2005, support for Hwang came in full swing. In June 2005, the Ministry of Science and Technology selected Hwang as the first recipient of the title Supreme Scientist, an honor worth US$15 million. Hwang, having already claimed the title of POSCO Chair Professor worth US$ 1.5 million, secured more than US$ 27 million worth of support in that year. President Roh had been acquainted with Hwang since 2003, and made a number of comments intended to protect Hwang from potential bioethical issues. In June 18, 2004, Roh awarded Hwang a medal and said, *"it is not possible nor desirable to prohibit research, just because there are concerns that it may lead to a direction that is deemed unethical."* In another instance at the opening of World Stem Cell Hub on October 19, 2005, Roh remarked, *"politicians have a responsibility to manage bioethical controversies not to get in the way of this outstanding research and progress."*

It was alleged that advisor Park Ki-young deliberately avoided to report Roh about details of Hwang's allegation for misconduct, while emphasizing a breach of journalist ethics by MBC. Park, after weeks of silence for her role in the controversy, announced her intent to resign from the advisor post on January 10, 2006. On January 11, 2006, the national post office stopped selling post stamps commemorating Hwang's research. The title of Supreme Scientist awarded to Hwang was revoked on March 21, 2006, after Hwang was dismissed from Seoul National University the day before.

Lawmakers' response

On December 6, 2005 a group of 43 lawmakers from the ruling and opposition parties inaugurated a body to support cloning pioneer Hwang Woo-suk. Members of the group, dubbed the *lawmakers' group supporting Professor Hwang Woo-suk*, pledged to help Hwang continue his experiments in pursuit of a scientific breakthrough. *"There are many lawmakers who, regardless of party affiliation, want to support Hwang. We will join forces to help Hwang devote himself to his studies,"* Rep. Kwon Sun-taik of the ruling Uri

Party said in a news conference at the National Assembly, who was also the leader of the group.

Reps. Song Young-sun and Chin Soo-hee of the GNP said they would provide their eggs to Hwang's research team. Meanwhile, the ruling and opposition parties called on the Korean Broadcasting Commission to thoroughly investigate the staffers of MBCs PD Notebook which broadcast a documentary program critical of Hwang with coercive tactics in interviews, and reprimand them. After most of Hwang's claims were confirmed fake on January 10, 2006, some lawmakers revealed that Hwang made several campaign donations to them and other lawmakers.

Rallies supporting Hwang

Many South Korean citizens rallied outside Hwang's laboratory; as more than 1,000 women pledged to donate their eggs for the scientist's research. Hwang has been in seclusion since apologizing in November 2005, for ethical lapses in human egg procurement for his research. The symbolic event was as a gesture from Hwang's supporters that says they intend to donate their eggs with 1,000 of their members after they took egg-donation pledges online via their website. *"Dr. Hwang will not be able to return to the lab, at least, until at the end of this week because he is extremely exhausted, mentally and physically,"* a key team member, Ahn Cu Rie, wrote in an e-mail to Reuters. At Hwang's lab at Seoul National University, women left bouquets of the national flower, a Hibiscus called the Rose of Sharon, for the scientist along with notes of encouragement. The stem cell research center that Hwang led before resigning said it hoped he would return, even though his lapses could hurt its efforts to work with other research institutions.

"So far more than 700 South Korean women have pledged to donate their eggs and the number is steadily rising," said Lee Sun-min, an official at a private foundation launched last week to promote egg donations. Thousands of patients have applied to participate in the research, hoping the technology could help treat damaged spinal cords or diseases such as Parkinson's. On Tuesday, an official at the lab said it was hoped that Hwang would return. *"We're waiting for Hwang to assume the leadership after some rest,"* Seong Myong-hoon told a news conference. But Seong said the controversy could

hurt the lab. That conclusion was reached after one of Hwang's close research partners, Ahn Cu-rie, returned Tuesday after a 10-day trip to meet with scientists in the United States and Japan, Seong said. Hundreds of South Koreans have offered to donate eggs for stem cell research in a show of support for cloning pioneer Hwang Woo-Suk despite his admitted ethical breaches.

Opposition to Hwang's nationalist supporters

Although many popular message boards in South Korea were overwhelmed by Hwang's supporters with nationalist fervor, other boards provided a counterbalance, including BRIC (Biological Research Information Center), SCIENG (Scientists and Engineers' community) and DC Inside Science Gallery. A member of BRIC, a website dedicated to biologists, first discovered the discrepancies in DNA analysis data in Hwang's paper and made them public. Other members followed suit, uncovering the fact that many photos presented in the paper were also fabricated. The Science Gallery of DC Inside, a popular internet forum in South Korea, also contributed to the revelation of Hwang's misconduct by discovering yet more problems in the paper and pointed out fallacies in Hwang and his supporters' claims. DC Inside's effort was instrumental in debunking Hwang's falsification to the public.

Concluding Remarks

From the foregoing an important observation is that though Dr. Hwang's professional demise is a severe embarrassment for the Korean government, he still has public support. According to the recent post mortem of Korean scientist's research, he did achieve a scientific first, though not the one he claimed. A team of Boston scientists who re-examined Dr Hwang's purported embryonic stem cells concluded that these were the product of virgin birth, meaning they were derived from an unfertilized egg. Other researchers have since developed embryonic cells from parthenogenetic eggs, but Dr. Hwang's team would have been the first to do so had its members recognized what they had done.

.....

ANNEXURE II

Peer Review (UK)

Parliamentary Office of Science and Technology (POST)

1. Post is an office of both House of Parliament charged with providing independent and balanced Analysis of Public Policy issues that have a base in Science and Technology. Peer review is the process used to determine how science funding is allocated, which research is published and where it is published. It is a system whereby research – or a research proposal - is scrutinized by (largely unpaid) independent experts (peers). In general, the process serves a technical (ensuring that the science is sound) and a subjective function (is the science interesting, important and/or groundbreaking?). Brief overview of how the process works to select science for funding and publication, although in practice, there is considerable variation in peer review processes between funding bodies and journals is as follows:

(i) Manuscript or grant proposal (application) arrives at appropriate funding body or journal. It can be considered by in house peer review team and either rejected or passed on to next stage.

(ii) Application is sent to appropriate (largely unpaid) external peer reviewers (referees).

(iii) Referees comment on application and make a recommendation (grade) regarding its suitability for publication or funding. Author may be permitted to respond to the referees comments at this stage.

(iv) All comments are returned to journal editor or funding body committee for consideration. Peer review panels consider referees comments.

(v) Application is accepted or rejected.

2. Purposes of Peer Review –

Peer review is used in the UK for three main purposes:

(i) Allocation of research funding. The main funding bodies such as the research councils and biomedical charities all use peer review for advice on which research projects should be funded in the first place and to assess the progress of funded projects.

(ii) Publication of research in scientific journals. Peer review is used to assess the quality of research submitted for publication and to assess its importance. The process thus influences what science enters the public domain, where it is published and what impact it will have (the more prestigious the journal, the greater the likely impact of the publication).

(iii) Assess the research rating of university departments. Peer review has been used as part of the Research Assessment Exercise (RAE) to judge the quality of research conducted by each department. The results are used to direct the distribution of public funds to each institute. In addition to the above, peer reviewed science is playing an increasingly influential role in the formulation of UK policy and decision making.

3. Issues – (i) Peer review is designed to improve the quality of research reporting and to prevent poor research from taking place. It is generally regarded as having the confidence of the research community. Processes such as the RAE are widely accepted as having raised standards, but there is surprisingly little evidence on the effectiveness of peer review from formal studies. One recent review found some evidence that the accuracy and readability of manuscripts is improved between submission and publication, although it was not clear whether this was due to peer review, or to technical editing. There is also some evidence that it is effective at weeding out poor quality research both at funding and at publication. In general, peer review is held to be beneficial to the scientific community and has become central to the process by which science is conducted. Issues raised by peer review are;

(ii) Frauds - Peer review relies on mutual trust and honesty: researchers must entrust their data/ideas to referees while referees must trust that researchers are telling the truth. Because of this reliance on trust, the peer review system is open to abuse. Recent years have seen a small number of high profile cases where the system has failed to detect fraudulent research, although these cases are to account for only a tiny proportion of peer reviewed research. Fraudulent research can take a number of forms such as fabrication, falsification, plagiarism, failure to disclose conflicts of interest and for other forms of scientific misconduct.

(iii) Detecting fraud – Recent years have seen a number of developments aimed at reducing scientific fraud, particularly in the area of medical research. For instance, both

the MRC and the Wellcome Trust have published guidance on good research practice and on procedures for inquiring into allegations of research misconduct. In 1997, a group of UK journal editors formed the Committee on Publication Ethics (COPE), to provide a discussion forum for issues concerned with potential breaches in research and publication ethics. It published guidelines on good publication practice in 1999, and meets regularly to consider possible cases of research misconduct referred to it by editors.

(iv) Other Potential Disadvantages –

(a) Bias - It has been suggested that peer review may introduce a number of different biases to decisions on funding and publication. For instance, a 1997 investigation by the Swedish Medical Research Council reported that female applicants had to be 2.5 times more productive than their male colleagues to get the same peer-review rating. There are also concerns that peer review tends to favour publication of positive results. One possible reason for this may be that editors are under pressure to publish results that generate big impact factors. This has led to concerns that the non-publication of negative results leads to bias in the scientific record. Other possible biases that may be introduced by peer review include language and institutional bias, with some studies suggesting that reviewers favour submissions from researchers at prestigious institutions.

(b) Preserving the status quo - It has been suggested that peer review is an inherently conservative process, that encourages the emergence of self-serving cliques of reviewers, who are more likely to review each others' grant proposals and publications favourably than those submitted by researchers from outside the group.

(c) Inefficiency - Peer review can be relatively slow and inefficient both for funding and publication. Reasons for this may include, failure of referees to keep to deadlines, inconsistency between referees, recruiting and retaining referees is increasingly difficult, and the lengthy time taken for editors and funding bodies to reach a decision regarding the fate of an application.

(4) Ways forward

Concerns over the peer review system are nothing new; reports recognized that peer review is under pressure, that a number of inadequacies requiring attention exist.

(i) Retaining referees - Some research councils are looking at requiring researchers awarded grants to act as referees for a certain period. In yet other scheme, referees who return their reviews on time are rewarded with points that can be cashed in at the end of each academic year, with the money being awarded to the reviewer's department. The scheme has resulted in a slight improvement in performance. Finally, there has been much debate over whether research funders and publishers should move away from the current (anonymous) system of peer review to a more open system.

(ii) Improving efficiency - Initiatives to improve the efficiency of the system include: Lightening the burden on reviewers, Setting new research in context, Fast-track publication, Reducing referee inconsistency, Moderation of demand, Improving the quality of funding proposals and Auditing the productivity of funding decisions.

(iii) Encouraging innovation - Research councils increasingly encourage scientists with innovative ideas to apply for small grants in order to conduct pilot studies. Many funding bodies now have special schemes for young researchers and those looking to work outside of their specialist field. The research councils are also increasingly using interdisciplinary committees to provide funds for innovative proposals that might otherwise fall between different funding bodies.

(5) Conclusion

Overview of whole subject – points to following;

(i) Peer review is important – it is the process by which researchers and editors seek to ensure that only high quality research is funded and published.

(ii) Peer review thus has a role to play in maintaining public confidence in scientific research; peer reviewed science also informs an increasingly wide range of policy decisions.

(iii) Although it is the best available system for assessing the quality of science, it is not perfect. Increased efforts are being made to improve the efficiency and transparency of the peer review process.

EU 7th Research Framework Programme (FP7)

Research Framework Programmes are the main instrument at EU level for supporting research and development. They have two main strategic objectives: strengthening the scientific and technological base of European industry and encouraging its international competitiveness, through research that supports EU policies.

The *7th Framework Programme for Research and Technological Development* (FP7 for short) will last from 2007 until 2013 and has a total budget of over € 50 billion. The money will (for the most part) be spent on grants to research actors all over Europe and beyond, in order to co-finance research, technological development and demonstration projects. Grants are determined on the basis of calls for proposals and a peer review process, which are highly competitive. Thus, a key characteristic of FP7, that differentiates it from the Structural Funds, is that there are no fixed national or regional allocations.

In order to complement national research programmes, activities funded from FP7 must have a "European added value". One key aspect of the European added value is the trans-national nature of many actions: research projects are carried out by consortia which include participants from different European (and other) countries while fellowships in FP7 require mobility over national borders. Indeed, many research challenges (e.g. major research infrastructures), are so complex that they can only be addressed at European level.

However, there are also opportunities for "individual teams" with no obligation for trans-national cooperation. In this case, the "European added value" lies in raising the competition between scientists in "frontier" research from the national to the European level.

The major building blocks of FP7 are the Specific Programmes: Cooperation, Ideas, People and Capacities.

Cooperation Fostering collaboration between industry and academia to gain leadership in key technology areas.

Ideas Supporting basic research at the scientific frontiers (implemented by the European Research Council).

People Supporting mobility and career development for researchers both within and outside Europe.

Capacities helping develop the capacities that Europe needs to be a thriving knowledge-based economy.

A detailed description of the structure and coverage of FP7 is contained in the following Box:

Box - The structure and coverage of FP7

Cooperation programme – the core of FP7

The core of FP7 and its largest component by far, the *Cooperation programme* fosters collaborative research across Europe and other partner countries, according to several key thematic areas. These themes are: health; food, agriculture and fisheries, and biotechnology; information and communications technologies; nano-sciences, nanotechnologies, materials and new production technologies; energy; environment (including climate change); transport (including aeronautics); socio-economic sciences and the humanities; space and security.

This programme also includes the new *Joint Technology Initiatives*, which are industry driven, large-scale multi-financed actions, supported in certain cases by a mix of public and private funding. Other highlights of this programme include Coordination of non-community research programmes, which aims to bring European national and regional research programmes closer together (e.g. ERA-NET), and the Risk-sharing finance facility.

Special attention is also being paid to multi-disciplinary and cross-theme research, including joint calls for proposals between themes.

Ideas programme – and the European Research Council (ERC)

The *Ideas programme* is the first time an EU Research Framework Programme is funding investigator-driven research at the frontiers of science and technology, independently of thematic priorities. As well as bringing such research closer to the conceptual source, this flagship FP7 programme is recognition of the value of frontier research to society's economic and social welfare.

The Ideas programme is uniquely flexible in its approach to EU research, in that proposed research projects are judged solely on the basis of their excellence, as judged by peer review. It is being implemented by the new *European Research Council* (ERC). The ERC will be run separately from the Commission, consisting of Scientific Council (to plan scientific strategy, establish the work programme, quality control & information activity) and an implementing agency (dealing with administration, support for applicants, proposed eligibility, grant management and practical organisation). The Scientific Council consists of representatives of the European Science Community at the highest level, who act in their personal Capacity, independent of political other interests.

Research may be carried out in any area of science or technology, including engineering, socio-economic sciences and the humanities. Particular emphases are being placed on emerging and fast-growing fields at the frontiers of knowledge, and on cross-disciplinary research. Unlike the Cooperation programme, there is no obligation for cross-border partnerships.

People programme – boosting European research careers

The *People programme* provides significant support for research mobility and career development, both for researchers inside the European Union and externally. It is being implemented via a coherent set of Marie Curie actions, designed to help researchers build their skills and competences throughout their careers.

The programme includes activities such as initial researcher training, support for lifelong training and development via trans-national European fellowships and other actions, and industry/academia partnerships. An international dimension with partners outside the EU is to further develop the careers of EU researchers, by creating international outgoing and incoming fellowships to foster collaboration with research groups outside Europe.

Capacities programme – building the knowledge economy

The *Capacities programme* is designed to help strengthen and optimise the knowledge capacities that Europe needs if it is to become a thriving knowledge based economy. By strengthening research abilities, innovation capacity and European competitiveness, the programme is stimulating Europe's full research potential and knowledge resources.

The programme embraces six specific knowledge areas, including Research Infrastructures, Research for the benefit of SMEs, Regions of Knowledge, Research Potential, Science in Society and International Cooperation activities.

Peer Review Process

The ERC's peer review process will be carried out by panels of independent high level scientists and scholars, supported by written reports of referees. The Scientific Council has come to an initial agreement on the structure of panels for the evaluation of "Starting Independent Researcher Grants" under the ERC's first call for proposals. This structure responds to a series of *overriding principles* that were taken into account in the decision making process.

Coherence is essential in the design of all structures and operations of the ERC. The mandate of the ERC covers research in all fields of sciences and humanities, with funding decisions based only on excellence. This reflects an overarching vision of research as a unitary activity of the creative mind transcending the particularities of broad domains and individual disciplines. It also reflects the critical role of interdisciplinarity and the constantly evolving nature of disciplines.

The ERC has been set up with high hopes and great ambitions, and has set amongst its goals the instigation of ***transformative changes*** in the European research landscape. The Scientific Council aims to set new examples and standards by sending forceful signals for such transformative changes that track and support changes in the sciences themselves.

The panel structure chosen reflects a ***forward-looking approach*** to science and research. The focus is on bottom-up top quality, leading edge, innovative research, as reflected in the term that describes the ERC's remit: frontier research. The innovative structure of the panels signals openness to changes in paradigm and revolutionary rather than ordinary science.

The ongoing evolution of scientific disciplines also demands that the panel structure includes an appreciation for ***interdisciplinarity***. Early on, the Scientific Council decided to keep the number of panels low, to promote such interdisciplinarity and a wide breadth of viewpoints within each panel.

The emphasis on excellence, independent of any other priority, leads naturally to a ***funding allocation independent of panel structure.*** This will be further guaranteed by retaining sufficient unallocated funds to support on a competitive basis highly meritorious proposals that bridge panels.

The panels themselves are to be interpreted in a ***flexible and inclusive*** manner with adequate space and arrangements for cross panel and interdisciplinary proposals. Furthermore the panel themselves will be adapted as necessary to the realities faced by the ERC during the evaluation process itself, including the number and distribution of proposals received. The Scientific Council is confident that the fundamental principles used in designing the panel structure are sound and robust and will enable an optimal evaluation process.

Initial Peer Review Panel Structure for ERC Starting Grants

SH1 Individuals and organisations: Economics, management, demography, geography, urban and environmental studies.

SH2 Institutions, behaviour, values and beliefs: Anthropology, sociology, political science, law, communication, social studies of science and technology.

SH3 The human mind and its complexity: Cognition, linguistics, psychology and philosophy.

SH4 Cultures and cultural diversity: Literature, visual and performing arts, music and cultural studies.

SH5 The study of the past and of cultural artefacts: Memory, history and archaeology.

PE1 Mathematical foundations: Pure and applied mathematics, theoretical computer science and mathematical physics.

PE2 Fundamental constituents of matter: High energy, particle, nuclear, plasma, atomic, molecular, gas and optical physics.

PE3 Structures and reactions: Condensed matter (structure, electronic properties, fluids,...), statistical physics, nanosciences, reactions.

PE4 Material sciences and methods: Material sciences, molecular architecture, analytical chemistry, synthesis (both inorganic and organic) and theory, physical and environmental chemistry, method development.

PE5 Information and communication: Informatics and information systems, communication technology, computer science, intelligent systems

PE6 Engineering sciences: Electronics, product design, process design & control, construction methods, fluid and solid mechanics, energy systems, bio-engineering.

PE7 Universe sciences: Astro-physics/chemistry/biology/geology; solar system; stellar, galactic and extragalactic astronomy; cosmology; space sciences, instrumentation.

PE8 Earth system science: Physical geography, geology, geophysics, oceanography, climatology, ecology, global change, biogeochemical cycles, natural resources.

LS1 Molecular, cellular and developmental biology: Biochemistry, molecular biology, metabolism, cell biology, signal transduction, embryology, structural biology.

LS2 Genetics, genomics, bioinformatics and systems biology: Molecular genetics, cell genetics, genomics, transcriptomics, metabolomics, computational biology, biostatistics, biological modelling.

LS3 Organismic physiology, including infection and immunity: Organogenesis, organ physiology, endocrinology, ageing, toxicology, parasitology, microbiology, virology, immunology.

LS4 Neurosciences: Neurobiology, neuroanatomy, neurophysiology, neurochemistry, neuropharmacology, systems neuroscience, neuroimaging.

LS5 Evolutionary, population and environmental biology: Evolution, adaptation, population biology, biodiversity, ecotoxicology, marine biology, radiation biology, environmental risks, environmental medicine.

LS6 Applied medical and health sciences: Clinical medicine, public health, psychiatry, surgery, epidemiology, biomedical engineering, veterinary medicine, pharmacology, medical ethics.

LS7 Applied biology and bioengineering, including agricultural sciences and biotechnology: Genetic engineering, GMOs, synthetic biology, plant biology, fisheries, forestry, environmental biotechnology, industrial biotechnology, biomaterials, biohazards.

Annexure IV

LIST OF PARTICIPANTS

1. Dr. Laxman Prasad
   Advisor,
   Department of Science and Technology,
   Technology Bhawan, New Mehrauli Road
   New Delhi – 110 016

2. Mr. R. R. Abhyankar
   Advisor,
   Department of Scientific & Industrial Research (DSIR)
   Technology Bhawan,
   New Mehrauli Road
   New Delhi – 110 016

3. Dr. K. Satyanarayana
   Sr. Additional Director General
   Indian Council of Medical Research (ICMR)
   Ansari Nagar
   New Delhi – 110 029

4. Mr. R. K. Hegde
   Additional Director,
   Centre for Collaborative and Advanced Research (CCAR)
   Central Ponter Research Institute,
   Prof Sir C.V. Raman Road, Sadashivanagar P.O.
   P.B. No 8066, Bangalore – 560 080

5. Dr S. Sankaran
   Director,
   Directorate of Extrameral Researcher
   & Intellectual Property Rights
   DRDO HQ/Ministry of Defence,
   Room No. 348, DRDO Bhawan,
   Rajaji Marg,
   New Delhi – 110 011

6. Dr Manoj Nesari
Dy. Advisor (Ayusveda)
Ministry of Health & Family Welfare
Department of Ayush
IRCS Main Building,
Red Cross Road,
New Delhi – 110 001

7. Dr S. N. Sahu
Dy. Advisor (Homeopathy)
Ministry of Health & Family Welfare
Department of Ayush
IRCS Main Building,
Red Cross Road,
New Delhi – 110 001

8. Ms. S. Ahlladini Panda, IA&AS,
Director,
O/o Pr Director of Audit,
Scientific Departments,
AGCR Building,
I.P. Estate,
New Delhi – 110 002

9. Dr. Vivekanand Kain,
Member – Secretary,
Nuclear Reactor of Fuel Cycle Committee,
Board of Research in Nuclear Sciences
Department of Atomic Energy,
Anushakti Bhawan, CSM Marg,
Mumbai – 400 001

10. Dr Naseem Ahmad,
Director,
Ministry of Environmental and Forests,
Paryavaran Bhawan,
Room No. 927,
CGO Complex, Lodhi Road,
New Delhi – 110 003

11. Dr. Harendra Kharkwal,
Research Officer,
Room No. 555,
Ministry of Environmental & Forests
Paryavaran Bhawan,
Room No. 927,
CGO Complex, Lodhi Road,
New Delhi – 110 003

12. Dr. Gulshan Wadhwa
Scientist 'D'
Department of Biotechnology,
Ministry of Science & Technology,
2, CGO Complex,
Lodhi Road,
New Delhi – 110 003

13. Dr. G. M. Linga raju,
Scientist 'C'
Department of Biotechnology
Ministry of Scientist & Technology,
2, CGO Complex,
Lodhi Road,
New Delhi – 110 003

14. Mr. V. B. Taneja
Senior Director,
Ministry of Communication & IT,
Department of Information Technology
Electronics Nikalian,
6 CGO Complex,
New Delhi – 110 003

15. Mr. N. K. Sharma
Ex. M.D. NRDC,
B-84, Hill View Apartments,
Vasant Vihar,
New Delhi – 110 057

16. Dr. Ashok Mohan,
Ex-Department of Alomic Energy,
D2 A/6, Vasant Vihar,
New Delhi – 110 057

17. Mr. K.. N. Johry
Ex – CSIR,
37 Hauz Khas Apartments,
New Delhi – 110 016

18. Dr J Dhar
Ex – DST,
B-1, Pamposh Enclave
Greater Kailash – I,
New Delhi – 110 048

From Waterfalls Institute of Technology Transfer.

19.	Dr K. V. Swaminathan	Chairman
20.	Mrs. Lakshmi Swaminathan	Vice Chairman
20.	Mr D. P. Singh	Director,
21.	Mr. B. K. Wadhawan	Director,
22.	Ms Lalita Gosal	Sr. Research Scholar

History of Peer Review

Annexure V

The first kinds of peer reviews developed in connection with the founding of scientific societies in the 17th century, and especially the Royal Society in England. The Royal Society found itself facing the problem of a large number of observations and experiments being presented to the society, without it ever being very clear about how reliable these were. Results reported by Members of the Royal Society had to be trustworthy. These "natural philosophers" were, after all, noble persons (peers) committed to the gentlemanly ethos that required them to be veritable. Accordingly, the self-financed research performed by or on behalf of the noble gentlemen was also considered to be credible and authentic. However, an additional means had to be found to ensure that the reports presented by unknown persons of lower standing were equally reliable. One way of confirming this was to have a Member of the Royal Society vouch for it. It was also possible for the experiment to be repeated before the members so that these could confirm that they had observed it, through which the validity could be vouched for. For example, even Robert Hooke had to repeat numerous experiments before the peers before he was himself allowed to became a member of the Royal Society. The authenticated findings were then published in the "Philosophical Transactions of the Royal Society". We can then conclude that the second scientific journal – the first having been the French "Journal des sçavans" – already included a quality assurance system in the form of peer review. However, it was only in as late as 1750 that an explicit peer review system was introduced for the "Philosophical Transactions" themselves. Officially, this was because it had been necessary to select papers from the huge volume of material that had been sent to the Society. Unofficially, it was because the Royal Society had come under strong political pressure. Prior to this, however, the "Académie Royale des Sciences" in Paris had already established a rigorous peer review system for the "Journal des Sçavans" as a concession to the French king, through which the Académie was allowed to publish independently. The introduction of peer review was not, therefore, caused by the wish for scientific quality control. Rather, it was a political compromise aimed at guaranteeing self-control in the interest of the establishment of the day.

Although peer review played an important role in the origin of modern science, it was only used here and there over the course of time. Research was largely privately financed and so state funding organisations did not exist that would have needed a review system. At the same time, most of the scientific journals were controlled by a single editor who decided which articles were published and which not. Only after the Second World War was a massive expansion in the scientific research system seen that led to the general use of peer review to assess and autonomously control science. Today, it is only natural in most subject areas for manuscripts and proposals to be sent to two or more anonymous peers from the same subject whose review then forms the basis for a decision to accept or reject the article in question.