Recommendations to the
Natural Sciences and Engineering Research Council

Grant Selection Committee Structure Review
Advisory Committee

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May, 2008

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Recommendations of the GSC Structure Review Advisory Committee

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1. Introduction

NSERC is completing a review of the current Grant Selection Committee (GSC) structure and associated processes for the Discovery Grants program. The goal is to ensure that the peer review process can accommodate rapid emergence of new areas, the increase in research crossing traditional disciplinary boundaries, and the growing workload of many committees.

To help guide it in its work, NSERC has appointed an external Advisory Committee for the GSC Structure Review [see Annex A]. Its charge was to advise NSERC Senior Management on:

- An appropriate GSC structure that is forward looking – ensuring that changes to the existing GSC structure:
    - are supported by clear justification,
    - lead to significant improvements in the GSC process,
    - maintain the effectiveness and efficiency of NSERC's peer review process, and
    - provide for maximum accountability to the research community, government and taxpayers;
- Possible new operational procedures of the GSCs;
- The management of the project, its effectiveness and completeness;
- The consultation process - ensuring that:
    - a sufficiently broad sample of the community has been engaged, and
    - an appropriate range of issues have been considered;
- An appropriate transition road map, if substantial changes to the structure are recommended – ensuring that the process for changing from the current system to the recommended system:
    - is viable and
    - is designed to minimize disruption to the client community of researchers and to GSC members.

The Advisory Committee adopted the following goals to guide its recommendations.

Fundamental Principles:

The GSC Structure Review project will examine the peer evaluation and funding recommendation process for the Discovery Grants Program to ensure that it:

1. achieves the objectives of the Program within NSERC's Vision of helping to make Canada a country of discoverers and innovators for the benefit of all Canadians by:
    o promoting and maintaining a diversified base of high-quality research capability in the natural sciences and engineering in Canadian universities;
    o fostering research excellence;
    o providing a stimulating environment for research training.
2. is transparent to applicants and reviewers, and can be easily explained to NSERC stakeholders.
3. is expert, fair and efficient.
4. effectively allocates funding.

Specific Goals:

The preceding Principles will be applied to meet the following goals:

1. A grant evaluation structure that is based on a comprehensive analysis of the current research environment.
2. Protocols that maintain confidence in the Program from the research community by ensuring that:
    o the Committees and their operations are recognized to be designed appropriately and to work effectively;
    o all proposals are assessed by peers who have an appropriate mix of expertise and background; and
    o the topics reviewed by the various committees are clearly defined and published.
3. A dynamic and flexible structure that responds to a changing research environment, with the expectation that:
    o there will be a comprehensive review, and if warranted a re-design, approximately every 10 years; and
    o minor fine-tuning can occur at any time.
4. Consistently high quality Committee review of proposals in established as well as new and emerging areas, that thereby:
    o eliminates any gaps in the ability to review proposals;
    o minimizes overlap between committees; and
    o expertly handles proposals at the interface with other Councils.

5. In-depth review of all proposals through innovative and flexible processes, while ensuring a manageable workload for Committee members, referees and staff.
6. Effective communication of exciting Canadian research.
7. Keeping administration costs reasonable.

2. Current Grant Selection Committee Structure

The existing structure, currently based on 28 discipline-oriented Grant Selection Committees, has been in place for some 30 years.

The current system is perceived as working well for applicants whose research area aligns well with one of the current committees. They receive a high-quality assessment by a well-qualified group of peers. In some cases, however, this natural alignment does not occur, and there is no obvious "home" for an application. The current system can have difficulty dealing with such applications.

Over the last 30 years, the committees have evolved through membership and growth, reflecting new research topics and changes in traditional fields. In parallel NSERC has accommodated a growing number of applications in two ways: by splitting a number of the committees, and by extending the normal duration of Discovery Grants, first to four, and more recently to five years.

However, the current system is facing several challenges:

- The research landscape is changing: access to leading-edge tools and facilities, raised expectations for performance, the recruitment to Canadian universities of research stars from abroad, the expansion of graduate programs and the creation of new graduate programs in institutions that did not traditionally have them, collaboration in large interdisciplinary projects, to name a few. Peer review policies and processes need to adapt to this changing environment.
- The rapid development of new areas of research, either within established disciplines or, increasingly, across traditional discipline lines (e.g. bio-engineering) in the context of a system that is inherently stable. It may be difficult for the existing GSCs to evolve as quickly as the research areas.
- The splitting of many GSCs to deal with workload that has grown too large for the existing committee structure. This increases the degree of specialization of individual committees, and could exacerbate the preceding problem.

Recently a new model has emerged - the Conference Model, first implemented by the Evolution and Ecology GSC and since adopted by three other GSCs. This model has allowed GSCs facing an increasing workload to manage it effectively and to maintain their broad purviews.

Under the Conference Model, committee members meet in different combinations to discuss applications grouped into a number of topics. These topics are determined before the meeting, based on the applications received in a given year.

The basic concept is similar to the different tracks in a conference with parallel sessions. In the current NSERC implementation of the Conference Model, there are two parallel sessions, each one typically lasting half a day. Each session treats a specific topic, requiring a specific combination of expertise from GSC members. Scheduling requires additional effort, but has been shown to work well.

3. Consultation Highlights

During the course of its work, the Advisory Committee considered a large amount of input from grant applicants, Deans, Chairs of Departments, Vice-Presidents Research and Scientific Societies, as well as statistics on applications. It also considered benchmarking studies of several international and national granting organizations.

While these results showed that most people felt the current system worked well, there were many requests for changes to individual committees to accommodate specific research areas that are not perceived to be handled well at the moment.

For example, 31% of the 4500 respondents to the web survey responded that there are current or emerging areas that are not handled well by the current system. The following areas were the most commonly cited as examples:
- Bioinformatics
- Biomedical engineering
- Biomedical technology
- Cognitive or neuro-sciences,
- Environmental sciences
- Microbiology/microbial ecology
- Nanotechnology/nanoscience (variety of applications)

While the strong majority of respondents expressed confidence in the current system, a significant minority of funded applicants questioned the appropriateness of the GSC that reviewed their application. Several survey questions elicited similar responses. For example, when asked whether their GSC had the necessary expertise to review their proposal, 75% of funded applicants answered "yes", 14% answered "no" and 11% were undecided. When unfunded applicants were included, the percentage of "no" responses increased – although many of the unfunded applicants responded "yes".

This concern regarding the appropriateness of GSCs was reflected in a number of proposals for the creation of additional specialized GSCs, for example in Microbiology, Operations Research, Marine and Freshwater Research, and Mining Engineering.

There were also concerns about the external refereeing process, as well as the process by which GSC members were selected – some respondents felt that too much emphasis is placed on representational balance rather than on research reputation.

Finally, there were some concerns about perceived funding inequities within GSCs and inequities between GSC budgets.

In March 2008 NSERC convened a large Focus Group session to discuss the conceptual design underlying the recommendations and two different examples of how the new model might be implemented. There was a strong preference for an organization that was mostly discipline-based.

4. Recommendations

The Committee advises NSERC to implement the structure and procedures described in the following set of recommendations, taken together as an integrated package.

The recommendations are presented in four groups.

- A. Committee structure
- B. Merit Assessment
- C. Funding Recommendations
- D. Periodic review of the system

A.   Committee structure

Recommendation A.1 *– NSERC is urged to implement a structure based on the "Conference Model".*

The conference model approach has shown to be effective in NSERC, and it has already been adopted by four Grant Selection Committees (GSCs).   Key benefits include:
- It adapts easily to emerging areas.
- It provides for an expert review of proposals.
- It avoids splitting disciplines into completely independent GSCs as a solution to workload pressures. Many disciplines cannot easily be split, and under the conference model a broader range of expertise is available.

- It is well adapted to dealing with proposals that crossover disciplinary boundaries.
- It provides a great deal of flexibility in terms of organizing the available expertise into a number of sections, each of which generally meets for a few hours.
- It is more efficient in the use of committee members' time, as there are few or no non-readers at any given time.

The Advisory Committee recommends a significant expansion of the current use of this model.

Description of Proposed Conference Model Panel Structure

Figure 1 – Conference Model Panel Structure
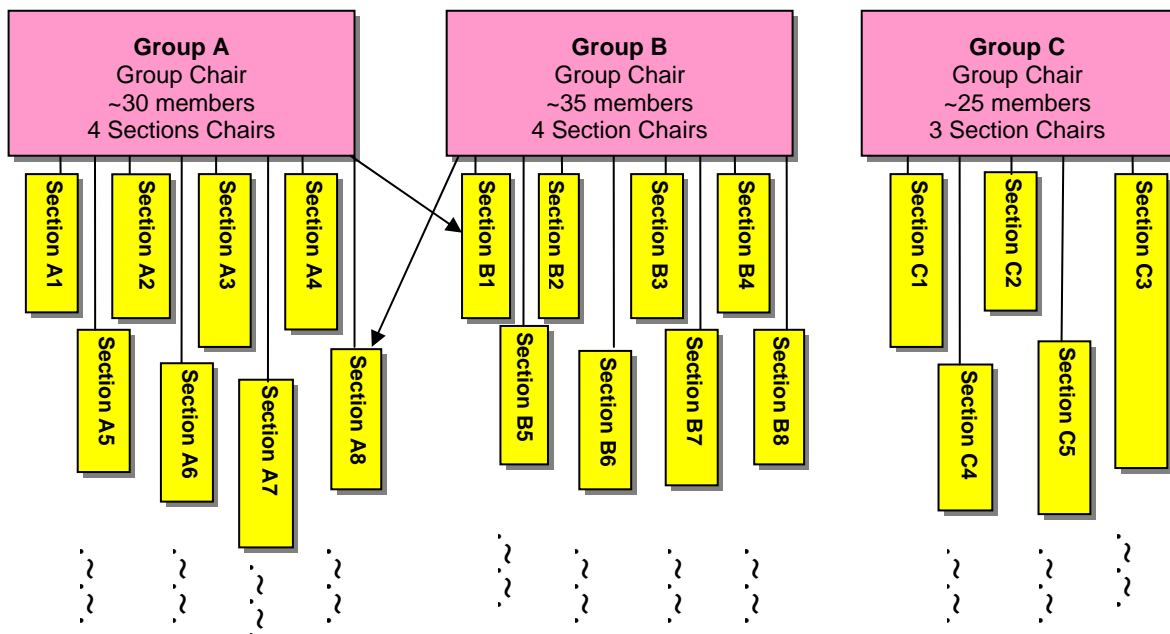
- The current 28 GSCs should be replaced by approximately 10-12 Panels, each with a number of Sections meeting in three or four parallel streams. The proposed Panels are similar to the current implementation of the Conference Model, but with double the number of members and double the number of parallel sessions. To achieve the required depth of expertise, it may be necessary to increase the number of panel members. (NSERC should seek assistance from operations research experts to help with scheduling).

- The Panels will largely be organized along disciplinary lines. In some cases, where it is appropriate for the area (e.g. Environment) thematic Panels may be established. NSERC has received many suggestions for

how research topics could be combined in different arrangements. NSERC is setting up small expert groups to provide advice and analyzing all the input received, and organize the Panel subject groupings.

- Each Panel will have a Chair, assisted by three or four Section Chairs (one for each parallel stream). The Panel Chair and Section Chairs constitute the Panel Executive Committee. The primary role of the Chair and Section Chairs will be to oversee the merit review of proposals and the functioning of the Sections; the Section Chairs will not normally be readers of proposals (unless their specific expertise is essential for the review of some proposals).

- With the support of NSERC staff, the Panel Executive Committees will decide each year on the assignment of Panel members to Sections, and confirm the topics to be covered by individual Sections based on applications received.

- Each Section chair will chair several Sections. For example, in the diagram above, Sections A1-1, A1-2, … will be chaired by the same individual.

- Each Section will have 5-8 members: the Section Chair, plus 3-5 readers per proposal and one or two additional (to deal with potential conflicts of interest and to provide linguistic capabilities).

- Normally, each Panel member will serve on several Sections.

- Members of one Panel can serve as full members of a Section under another Panel (as indicated by the arrows in Figure 1).

- Distributing the Panel meetings over two weeks [because of the number of NSERC staff required to support the meetings] means that not all areas of expertise are available at the same time. This will make some combinations of disciplines more difficult to evaluate. Instead of face-to-face meetings, some members may have to be brought in by teleconference.

Implications of broad implementation of Conference Model

- With the recommended change to a greatly expanded use of the conference model and the inherent flexibility of organizing around topics depending on the proposals received each year, topic areas involving members from separate Panels may reduce the number of proposals reviewed by the Interdisciplinary GSC (e.g., biomedical engineering).

- The conference model, incorporating many specialized Sections, will provide flexibility and enable expert review. In general, the Sections will provide more specialized expertise than is the case with the current GSCs.

- All applications related to a topic should be reviewed together – whether these are from first-time or renewing applicants. Members will apply career-stage appropriate performance assessments of contribution and potential for contribution. For example, early career applicants will not be expected to have the publication and training record of a senior researcher.

- Under this system, each proposal will be reviewed by approximately five panel members (two internal reviewers who will do a detailed analysis and three additional readers) and three external referees. This will reduce the workload on Panel members, compared to the current system, which typically has seven or more GSC members participating in the review. Several GSCs have already questioned the value added by this number of readers. Reducing the number of readers will help to reduce the preparation time required of panel members. Additionally, depending on scheduling arrangements, it is possible that not all Panel members will have to remain in Ottawa for the entire review week. This will also facilitate bringing in international members for a few days rather than for an entire week.

Recommendation A.2 – *Evaluations of the quality of proposals should be made by the Sections; Funding Recommendations should be made by the Panels.*

The Committee recommends that budgets be allocated at the level of the Panels and not at the Section level. Recommendations regarding funding of proposals should be made by the Panel Chair and the Section Chairs on the basis of the quality rating assigned by the Section to individual proposals, thus separating the task of scientific evaluation from that of making funding recommendations.

Recommendation A.3 – *The composition of Panels must be balanced.*

Panel members should be appointed to ensure competent reviewing with an appropriate mix of expertise and background. There needs to be some representation from the various regions of Canada and abroad, from universities of various sizes, academic researchers and researchers[1] and

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[1] NSERC could consider a system, patterned loosely after the German DFG system, in which universities and societies are actively invited to nominate members. Unlike the DFG system of elections, however, NSERC should continue to make the final decision on appointments.

research users from other sectors, as well as an appropriate gender balance, but these balances should only be attempted at the level of the Panels. At the Section level, balance by region, institution size, sectors and gender should not be a factor. It is, however, essential to provide the ability to read proposals in both official languages at the Section level as appropriate.

Additionally, for Panels and Sections in which there is an overlap between science and engineering, there must be a balance in the representation of the two traditions. Members need to have an operational understanding of the different approaches, dynamics and performance indicators to research of both science and engineering.

Recommendation A.4 – The Committee is pleased by the desire of the Tri-Councils to find ways to harmonize their processes and to develop mechanisms to fund research by individuals or by teams that crosses the boundaries between Councils. The Committee encourages NSERC to continue to work with the other Councils in the pursuit of these goals.

Recommendation A.5 - The Committee recommends that the main mechanisms for supporting research at the interface between Councils be through other existing or new dedicated programs, rather than as a component of the Conference model.

B.   Merit Assessment

Recommendation B.1 – NSERC should implement a scheme for binning scientific assessments (i.e., grouping them into several discrete levels). The scientific assessment should be communicated to applicants.

The current system involves a time-consuming process for recommending grant levels and results in a perceived fine ordering of quality of research based on small differences in grant funding level. Based on its experience, the Committee believes that applications of equal merit and costs of research do not receive consistent treatments across GSCs, or sometimes within GSCs. This can be on account of seniority within the system, or the results of the former Reallocations Exercise.

In its place, NSERC should implement a scheme for binning the quality of proposals (i.e. grouping them into a few discrete levels) on the basis of the Discovery Grants program selection criteria.   The result of the scientific assessment will be a classification of applications into quality categories or

bins (the number of such bins remains to be determined), such as 'Must Be Funded', 'Should Be Funded', 'Acceptable' and 'Do Not Fund'.

Recommendation B.2 *– Responsibilities of Sections*

- Sections should assess the quality of proposals according to each of the following criteria:
    1. scientific or engineering excellence of the researcher(s);
    2. merit of the proposal;
   3. contribution to the training of highly qualified personnel

    These three criteria should then be combined and used to assign a bin designation that is provided to the Panel Executive Committees.

Additionally, Sections will assess

1. *the appropriateness of the budget justification* Applicants will be required to put their Discovery Grant request in the context of the overall budget of their complete research program, and explain the percentage of their time they will spend on this component.
2. *the relative cost of the proposed program of research* as low, medium or high for the topic area. Sections should be provided with NSERC's assessment of the average cost of research in each field.

They may also make specific recommendations regarding the cost of research in exceptional cases. See Recommendation B.5

Figure 2 – Funding Recommendation Flowchart
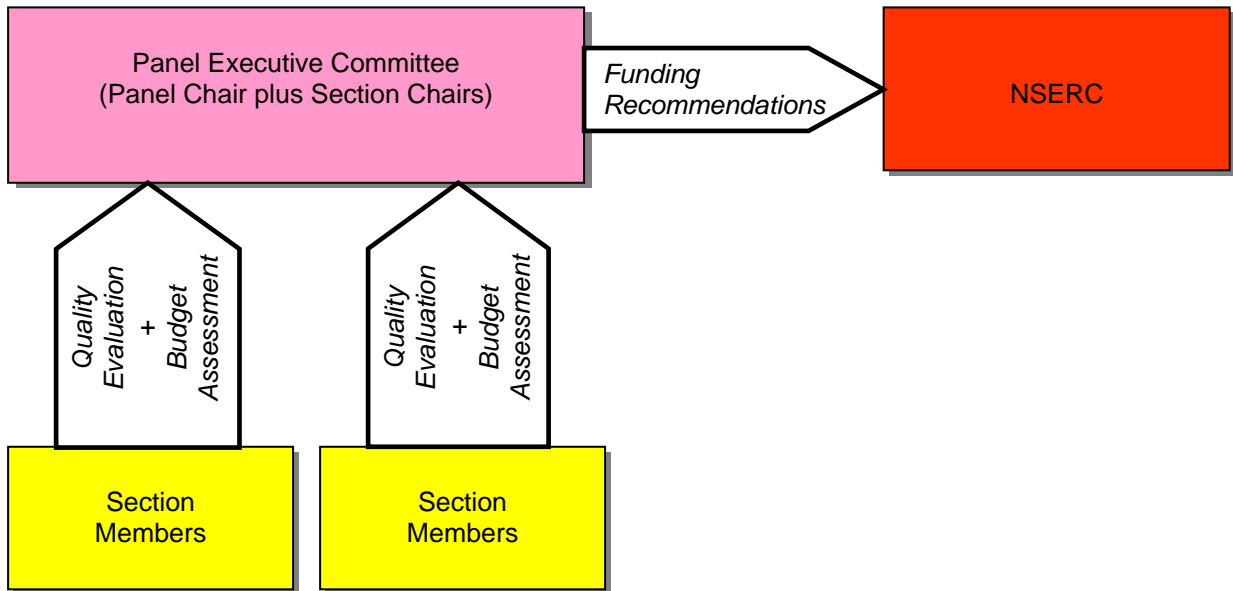
Recommendation B.3 – *NSERC should develop standardized criteria for evaluation of research excellence*

In the past, GSC recommendations have been in the form of dollar amounts, which were constrained by the total funds available in the GSC budgets. With the implementation of the Conference Model, the Sections will need guidance on how to rate proposals consistently, across fields, using the "bins". NSERC will need to develop descriptors that clearly define the expectations for the three criteria that collectively give rise to the final bin designation.

Consistency among Section evaluations

The Section Chairs, meeting with the Panel Chair as the Panel Executive Committee, will assess the consistency of evaluations among the Sections forming part of a given Panel. Consistency will also be enhanced by the fact that Panel members will serve on several Sections.

It is very difficult to compare applications from different fields in an absolute sense, even with the use of standardized criteria. Therefore, it will be necessary to have a forced distribution of applications across bins. For example, one could require that a particular category (bin) contain no less than 10% and no more than 20% of the applications.

Recommendation B.4 *– NSERC should provide clearer instructions for external reviewers on what is expected of them, in particular on quality guidelines.*

External reviewers should compare applicants to their peers, and their proposals to other proposals in the field, using identical criteria. To facilitate this, NSERC will devise a structured report form with specific categories on which to comment and clear descriptions that will be used for these comparisons.[2]

Recommendation B.5 *– Research Costs*

The current NSERC policy on "need for funds" is described in the Peer Review Manual. However, this policy needs revision. The revised policy should be clear and should be interpreted uniformly.   The Committee recommends that "research costs" replace "need for funds" in NSERC's funding policy.

- Applicants should submit a clear budget set in the context of their overall research program and other sources of funds.
- The availability or otherwise of funds from other sources (e.g., federal or provincial funding, or university research support) will provide needed context for understanding the applicant's total research program. However, it should not be a factor in determining the costs of the research component for which NSERC funding is requested. Applicants should not be penalized because they have been successful in obtaining additional funding from other sources.
- Sections should be asked to comment on whether the proposed budget to be funded by NSERC is reasonable and well-justified.
- The cost of an individual or team's research is influenced by two main factors:
  - Discipline – average research costs in each discipline will be used to calculate allocations to Panels as well as to set the baselines of "average costs" in the grids used with the binning process. For example, experimental physicists typically have higher research costs than mathematicians.

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[2] If this proves to be insufficient to improve the reviewing process, NSERC should consider implementing a "College of Reviewers" as used in several other countries, such as the UK and Australia. Under this system, reviewers are appointed to the college for a specific term. They are oriented in the expectations and policies of the granting council and program, and they agree to review a certain number of proposals each year. Membership in the College is a heavy commitment, but it carries with it a high level of prestige in the research community. This model was considered by the Committee and found to bring advantages in terms of improving the consistency of external reviewing. However, the committee hopes to achieve these advantages without implementing a formal College of Reviewers model.

o Individual variations within a discipline – including both the scope of research and the scope of the associated training of HQP. This will be assessed by the Sections in terms of "low", "medium", or "high" – with the potential to recommend a non-standard amount in exceptional circumstances

C.   Funding Recommendations

Recommendations in this section address:

1. Budget allocations to Panels
2. Funding of individual research proposals

Recommendation C.1 – Budget allocations to Panels

Following the termination of the Reallocation Exercise, NSERC's Council decided that future funding allocation processes should be based on population dynamics and the cost of research.

The "population dynamics" factor should be based on the number of applicants each year in a given discipline. There will be no historical component to Panel allocations. In addition, NSERC has developed models that reflect the relative costs of research.

It is important to note that NSERC's budget is not large enough to fund all of the research costs. Therefore, another step in the calculation of the allocations to panels is to scale all allocations by the same factor so the total fits within the Discovery Grants program budget.

It is not possible to predict all eventualities before the proposals are evaluated by the Sections. For example, it may happen that in a given year there is more than the usual number of top-ranked proposals in a particular Panel, as fairly evaluated using the criteria. In allocating the budget to Panels, NSERC should create a small reserve (a few percent of the competition budget). The Panel Chairs, acting as a committee in consultation with Program executives, will decide on the best use of this reserve. The default use will be to allocate it to the Panels proportionally to the main allocation.

To encourage realistic budget proposals from applicants, NSERC should publish the average funding available per Panel – or per discipline – each year before the competition begins.

Envelope Funding for Sub-Atomic Physics (SAP) – The SAP GSC has managed a pool (envelope) of funding covering both capital and operations costs of NSERC-funded projects since 1990. Most of these projects are very long term, from concept through development, construction, operation and data analysis. The planning for this is supported by a community-developed Long Range Plan and priority setting exercise. Management of this funding depends on the stability for a dedicated pot of money. The SAP funding is not part of the Discovery Grant program, and decisions on SAP funding should be made separately and not as part of the proposed structure.
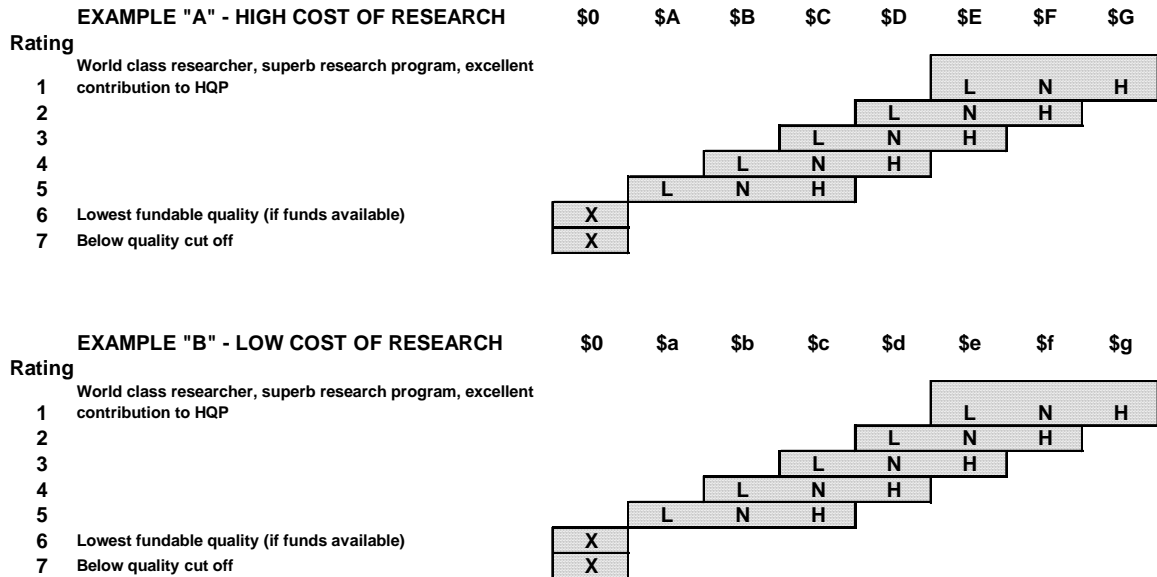
Recommendation C.2 – *Funding of Individual Research Proposals*

Panels will develop the funding recommendations to NSERC. This will be done by the *Panel Executive Committees.*

- Each Panel will have an Executive Committee, comprising the Panel Chair and the associated Section Chairs. The Panel Chairs will replace the current Group Chairs, and will be members of NSERC's Committee on Grants and Scholarships.
- The Panel Executive Committee makes funding recommendations on behalf of the Panel, and gives instructions to the Sections on behalf of the Panel. It also organizes Panel members into the various Sections.
- Panel Executive Committees will translate the assessments of quality and cost of research from the Sections into funding recommendations using a grid appropriate to the research area of the applicant(s). Although in principle each research area would have a different cost of research, areas with similar research costs could be grouped together and could use the same grid. There would be a different grid for each group of research areas with similar research costs. See Figure 3 for examples.
- Some excellent researchers submit relatively modest financial proposals. NSERC should not provide more than the amount requested, even if this amount is lower than the range of funding indicated on the grid for the appropriate research area.
- The Panel Executive Committees will ensure a consistent application of quality ratings across Sections.
- Panel Executive Committees will ensure that the total funding recommendations do not exceed the Panel budget.
- The Panel Chairs will be responsible for advising NSERC on allocation of the budget reserve to individual Panels (see below).

Figure 3 – Funding Scenarios

		$0	$A	$B	$C	$D	$E	$F	$G
EXAMPLE "A" - HIGH COST OF RESEARCH									
Rating									
1	World class researcher, superb research program, excellent contribution to HQP						L	N	H
2						L	N	H	
3					L	N	H		
4				L	N	H			
5			L	N	H				
6	Lowest fundable quality (if funds available)	X							
7	Below quality cut off	X							

		$0	$a	$b	$c	$d	$e	$f	$g
EXAMPLE "B" - LOW COST OF RESEARCH									
Rating									
1	World class researcher, superb research program, excellent contribution to HQP						L	N	H
2						L	N	H	
3					L	N	H		
4				L	N	H			
5			L	N	H				
6	Lowest fundable quality (if funds available)	X							
7	Below quality cut off	X							

Recommendation C.3 – *Panels should follow a more uniform approach to funding recommendations*

Panel Executive Committees should be given clear rules and be required to follow a more uniform approach to funding, plus clear direction that funding is to be based on the selection criteria and not by the size of the previous grant. Of course, applicants whose quality evaluations remain consistent are likely to experience consistency in the size of their grants.

The success rate should be determined by the quality of the applications. Initially, NSERC staff will need to set the expectations for quality and more explicit requirements for outputs/contributions, as well as the funding distribution function in terms of the bins. In other words, Sections will need guidance on the fraction of applications that should normally be placed into each bin.

Consistency between Panels' recommendations will be achieved by the Panel Chairs, who will meet together in their own policy sessions, and additionally as members of the Committee on Grants and Scholarships.

D. *Periodic Review of the Structure*

Recommendation D.1 *– There should be a periodic review of the system as research evolves.*

It is important that the recommended structure not be considered as static. It should be monitored and potentially adjusted on an annual basis. We note that the Conference Model is inherently dynamic, as the Sections can be tailored each year depending on the proposals received.

Additionally, the complete structure needs to be reviewed periodically – every five to ten years – to make sure that it still satisfies the principles stated at the beginning of this document.

NSERC GSC Review
External Advisory Committee Membership

Adel Sedra (Chair)	Dean of Engineering, University of Waterloo
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Nils Petersen	Director General, NINT, Edmonton
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Mario Pinto	Vice President-Research, Simon Fraser University
Gary Slater	Dean of Graduate Studies, University of Ottawa
Patrick Desjardins	Professeur, CRC, École Polytechnique
Carolyn Watters	Dean of Graduate Studies, Dalhousie University
Nick Cercone	Dean of Science and Engineering, York University
Warwick Vincent	Professeur, CRC, Université Laval; NSERC Committee on Grants and Scholarships
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