Executive summary

'When a man is educated, an individual is educated; when a woman is educated, a family and a country are educated.'

Mahatma Gandhi

Over a century ago, women began seeking access to formal science and technology (S&T) education and to the full expression of their training and talents in subsequent careers. These quests have been a long hard fight, met by opposition sometimes blatant though often subtle. But while women have made inroads, their representation in most S&T fields—particularly at leadership levels—remains well below that of men.

National legislation in some countries, together with many campaigns, has helped as have efforts by a few forward-looking universities and companies. But for the most part, institutions have been resistant to fully opening their doors to women in science and technology, as well as to eliminating the obstacles they are likely to encounter if they do manage to get inside. Thus women scientists and engineers drop out at the early career stage at a much higher rate than do men, and few women are found in the upper strata of the hierarchy.

Under the circumstances, it is amazing that any women at all have been able to attain S&T leadership positions. Extraordinary individuals of sheer dedication and determination, who also were fortunate in finding a male mentor or supporter, account for the occasional success story. But given that males and females each constitute half of the human race, and given that S&T aptitude is just as likely in either gender, it makes no sense to accept just the exceptional cases as the best we can do. Full inclusion is the only acceptable outcome.

An urgent need for academies' actions

A critical omission has been the wholehearted commitment to inclusiveness on the part of the existing S&T leadership. Without support from that establishment, women can only progress so far. This is where academies can play a major role, as they represent the scientific and engineering elite and are thus held in high esteem. Moreover, their members are leaders at universities and other research institutions; and in many countries they are trusted advisers to government.

In that spirit, the InterAcademy Council (IAC) established the Advisory Panel on Women for Science with a mandate to propose what academies around the world can do to remedy the persistent and widespread underrepresentation of women in science and technology. This report is a result of that IAC initiative.

Based not only on a moral standpoint but largely out of pragmatism, the Advisory Panel concludes that the world's science and engineering academies urgently need to take action on this problem. That is to say, a greater range of styles and points of view, made possible by a diversity of scientists and engineers, will enrich the S&T enterprise as well as the societies it serves. Moreover, global capacity

'Voices that are silenced or ignored, for whatever reason, represent not only an injustice but also a valuable resource that has been wasted, a tragic waste of human capital.'

James Padilla,
President, Ford Motor Company (2005)

building, so strongly advocated in earlier IAC reports (IAC, 2004a; 2004b), is impossible without full engagement of women at the grassroots—and without the academies' help in making this happen. The Advisory Panel maintains that academies will exert true leadership and have considerable impact on the lives of people around the world by adopting and advocating some fundamental reforms in institutions' routine operations.

Toward inclusion: good management practice

Chapter 1 provides an introduction to the problem of women's underrepresentation in science and technology and explains why its solution truly matters. It notes the growing concern of governments and other entities around the world, justifies in some detail the critical role of the science and engineering academies, and specifies the Advisory Panel's mandate for this report.

Chapter 2 reviews some of the past and present activities of organizations that have been effective in advocating for and supporting the education and career prospects of women scientists and engineers. It describes the educational and inspirational efforts of women's groups, some of the national assessments and initiatives undertaken by governments in pursuit of gender equality, and trends both in improving access to higher education in science and technology and in enhancing prospects for employment that is not only productive but offers opportunities for advancement.

Chapter 2 also describes the application of 'good management practice,' which the Advisory Panel strongly recommends to the academies for their own operations and for dissemination to the larger S&T community. This management principle—an effective, well-demonstrated means of making an organizational culture inclusive of minorities, be they ethnic minorities or women in institutions dominated by men—is shared by many of the successful inclusion efforts reviewed by the Advisory Panel. Good management practice aims for establishing a culture in an organization that values all of its members and expects them—and gives them the opportunities—to function at their full potential for the benefit of that organization.

Elements of good management practice include:

- Commitment from top levels of the organization;
- Established infrastructure, such as a diversity committee;
- Review of all policies and procedures for possible differential impact on men and women;
- Transparency in all communication, recruitment, promotion, and awards;
- Wide inner circle, where decisions are made, that is inclusive;
- Leadership training and mentoring;
- Supporting a healthy work-family balance;
- Regular collecting of sex-disaggregated data and monitoring of progress.

As specified in the successive core chapters (3, 4, and 5) of this report, good management practice forms the backbone of the Advisory Panel's recom-

mendations for academies in the following three areas:

- Attract women and girls to science and technology, support their education throughout the 'pipeline', and retain and advance them in their careers.
- Fully include women in global capacity-building efforts.
- Fully include women in the academies' own organizations.

Advancing women in S&T careers and at the grassroots

Chapter 3 considers programmes—aimed at increasing the numbers of women progressing through science and engineering education, training, and careers—that have been developed by governments, professional organizations, corporations, universities, and even some academies. Such programmes cover enhancement of women scientists' and engineers' visibility, the importance of role models, access to mentoring and networks, and initiatives that provide earmarked resources to women in launching their careers or reestablishing them after a family-related break. Academies, individually and jointly, are requested to support ongoing programmes of this sort and to develop measures of their own that give opportunities and recognition to women scientists. It is worth noting, however, that good management practice, once implemented, will eliminate much of the need for special programmes because their provisions will have been built into the organizational structure, thereby benefiting all employees.

Chapter 4 advocates for academies' help in engaging grassroots women (who live and work in developing countries, often without the benefit of much formal education) in global S&T capacity building. This perspective—unique to reports of this type—is nevertheless complementary to IAC's visions for creating a better world. Just as a country's capacity building requires the development of an S&T cadre, it also requires the mobilization—the engagement and empowerment—of the country's citizens. This report argues that the billions of individuals at the grassroots around the world must be enabled to apply the fruits of science and technology, such as useful tools, products, and services, for the benefit of their countries' economies while improving their own lives. Such engagement cannot occur while excluding half of the human race, let alone the half that does the majority of daily hands-on work. Therefore women in the developing world's villages—rural townships and urban enclaves alike—must become engaged in the application of modern technologies.

The chapter goes on to sketch the three-pronged process needed for this engagement. First, access to and quality of primary and secondary education for girls must be dramatically improved while teacher training, especially in mathematics and science, receives urgent attention. Second, large numbers of women scientists and engineers must be educated at specialized research centres. Third, these women must form cadres that are dispersed from centralized institutes to local knowledge centres. Preferably indigenous to the local culture, these skilled cadres then transfer modern technology to local women while building on their traditional skills and experience.

The chapter then takes up the vital issue of improvement of public understanding of science and technology, both in developing and developed countries. To truly embrace it, academies may sometimes have to take their events and programmes out into the field—into communities that may well be remote—rather than limit their venues to university campuses or research institutions. Such public-engagement programmes, in addition to transfer-

ring knowledge, also enable the full cross-section of society to be involved in the social and ethical discussions that lead to better-informed policy. And, not least, such programmes raise awareness of the opportunities of working in science and technology.

What the academies must do

Chapter 5 directly addresses the academies, where women scientists and engineers presently form a small minority (typically less than 5 percent) of the membership. As with other kinds of organizations, the Advisory Panel recommends that in the academies themselves and in the research institutes that some of them manage, the fundamental approach for change be the adoption of good management practice. This implies a firm commitment by the president and council to inclusive practices and to putting gender issues permanently on the agenda. The Advisory Panel also recommends that each academy establish a diversity committee consisting of both male and female academy members. This committee should report directly to the president and council, helping them to develop the necessary policies and programmes.

A high priority is enhancement of the pool of qualified women to be considered for nomination to membership. Further, each academy needs to work on achieving greater visibility of women scientists in the publications and educational materials it develops. Women must be invited to chair conferences and speak at seminars, and they must be appointed to panels and committees that the academy organizes.

Academies that sponsor research need to give attention to the potential gender implications of proposed projects and their resulting publications. For example, do men and women researchers have equal access to grant money? In cases where a study could be influenced by the gender of the researcher, has the principal investigator made an effort to establish a gender-mixed team? Have the results been tested for differential impact on men and women, and are they free of bias? In addition, academies that evaluate research institutions need to include the working conditions of women scientists and engineers among their evaluation criteria.

For monitoring the results of inclusive programmes initiated by an academy, it is essential that sex-disaggregated data be routinely collected and then reported at the academy's annual meeting. For too long, the scientific establishment has dealt with the gender-equality issue essentially through the motto 'No data, no problem.'

The Advisory Panel recommends that, when interacting with their countries' governments, academies advocate for full inclusion of women in science and technology through measures such as nondiscrimination legislation, a national office focused on women's issues in science and technology, reform of textbooks and teaching materials, and the monitoring of girls' and women's progress.

Of course, academies can act not only individually but jointly. In that regard, the Advisory Panel recommends that IAC and its parent organization the InterAcademy Panel for International Issues (IAP), adopt the following initiatives:

- Commit to good management practice in their respective operations.
- Collect sex-disaggregated data from their constituent academies and report on these data at their annual meetings.
- Pay attention to gender issues in the studies they undertake.
- Facilitate exchange of information between academies and other organizations about innovative and effective programmes for developing an inclusive culture.
- Develop international partnerships to secure

funding for women-in-S&T programmes.
- Make use of various means of communication, such as S&T-friendly radio and television programmes, for increasing the public understanding of science with particular focus on girls and women.

Chapter 6, a summary, complements the other chapters—particularly Chapter 5—by reorganizing the report's recommendations by academy function, in recognition of the wide variations between academies. Categories include academies as honorific societies, as advocates of global capacity building, as employers, as sponsors of research and evaluators of research institutes, and as national advocates for education. Coordinated actions for academies—for instance, through IAC and IAP—are also proposed.

For immediate action

The Advisory panel proposes the following items for immediate implementation:
- Academies formally commit to good management practice within all levels of their organizations and research institutes by signing a commitment statement (see sample statement below).
- Each academy designates a panel—preferably, gender-balanced—to be responsible for gender issues.
- Academies enlarge the nominations pool of women scientists and engineers.
- The IAC disseminates this report widely, together with supporting materials, through posting on its website and other means.

Sample statement of commitment for academies

The president and council of the academy commit to full inclusion of women in science and technology. The academy will:
- ▶ Adopt good management practice—tools for inclusiveness—in its institutions and advocate such practice across the S&T community.
- ▶ Establish a committee that addresses gender issues and ensures follow-up.
- ▶ Promote women members to decisionmaking levels and include them in panels and committees.
- ▶ Increase the number of women scientists in the nomination pool for membership, prizes, and awards.
- ▶ Give visibility to women scientists and represent women in the academy's portrayal of science.
- ▶ Pay attention to gender implications of research sponsored or evaluated by the academy.
- ▶ Ensure that the criteria for evaluation of research institutes include organizational culture.