Research and innovation

Research always brings to mind the paradigm of an absent-minded scientist playing aimlessly with his pencil (and computer) seeking some universal truth. It is a paradigm that gave us, over the centuries, great progress in science, and it resulted in relative prosperity for mankind. The basis for this paradigm was and still is that the researcher is highly intelligent, self-motivated, and rather undisciplined. Can we go to the next millennium with this paradigm? In a society where everything is measured, quantified, and rationalized, how can researchers continue to live in an idealistic world? We already see the signs of trouble. Research budgets and research institutes are under pressure in both the public and private sectors. This is the time to revise our position, especially in the fast-moving area of information technology.

Research is not the goal but the means. Searching for something cannot be the goal; finding it is the goal. Research, like any other ac-
tivity, is measured by its results. When the area of research is related to an economic sector, the results should be concrete and looked upon as "products." The product of computer science research is innovation. We constantly question existing knowledge in order to provide something new, to innovate in terms of concepts, methods, materials, or whatever.

This innovation is effective when it has three aspects:

(a) It provides a significance different from what it was known before; let's call it the quality of innovation.
(b) It becomes sufficiently widespread to make a real difference; let's call it the (audience) penetration of the innovation.
(c) It does so quickly; let's call it the speed of innovation.

Innovation is achieved in different ways. We will distinguish at least three: through ideas, through people, and through products.

Idea innovation

Idea innovation follows a well-known pattern of scientific research. On the basis of what is known, something is discovered by research, and it is documented through publications. In this way, the state of the art is advanced, at least in principle. Idea innovation is mainly based on originality. There is no need to discover the same result twice. Publication serves to make the results well known and avoid duplication. Publication itself is not a goal, it is only the means to inform other researchers so they can avoid duplication and collect the accumulated knowledge. It is a well-accepted principle that idea innovation is judged in terms of its quality. Penetration and speed of the innovation are important but not critical. Quality is paramount. How different and surprising is the new result is also relative to some extent on how difficult it was to achieve.

Idea innovation needs top talented people who can make contributions on very difficult and important problems. The newer the area of scientific activity, the better chance to get, with the same effort, a surprising result. Originality and quality have a better chance in new fields. On the other hand, new areas have a smaller audience of active researchers and fewer publication venues, so the penetration is less and it takes more time to develop. If the area expands quickly, then both speed and penetration of the innovation are well served. This is exactly what happened in the first fifty years of the ACM, where we saw new and rapidly expanding areas. Many people became famous on the basis of high-quality publications at the beginning of a new area. It is wonderful that