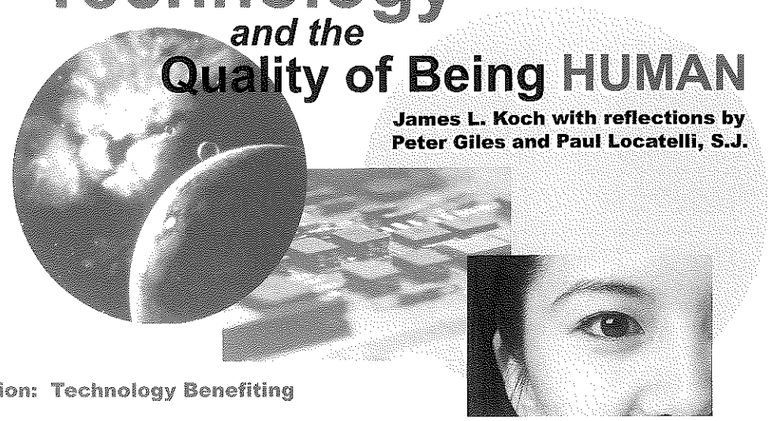
Technology *and the* Quality of Being HUMAN

James L. Koch with reflections by Peter Giles and Paul Locatelli, S.J.



Introduction: Technology Benefiting Humanity

tech-no-lo-gy. 1. The branch of knowledge that deals with the creation and use of technological means and their interrelationship with life, society and the environment, drawing upon such subjects as industrial arts, applied science, and pure science.

hu-man-i-ty 1. All human beings collectively, the human race; 2. the quality and condition of being human.

Three words—**Technology Benefiting Humanity**—reflect both the title and the essence of The Tech Museum of Innovation Awards that are being launched in this millennium year. These awards seek to foster "an understanding and awareness of the benefits of technology for the common good." But, these benefits are not guaranteed. They reflect the conscious striving and imaginative work of individuals, corporations, and social organizations. It is these efforts that the awards recognize. Santa Clara University's Center for Science, Technology, and Society is partnering in this unique endeavor because it shares the San Jose Tech Museum's objective of interpreting and communicating new applications of technology to the citizens of our global society. Both organizations intend that these awards will educate and inspire current and future generations of scientists, engineers, and practitioners as they seek to advance the creative use of technology to serve human needs.

In this article we will describe the origin of this award program that emerged through parallel dialogues in the Center for Science, Technology, and Society and The Tech Museum of Innovation. We will also reflect on the value of a bifocal view of technology, one that simultaneously considers advances in science and technology with an appreciation of the unique challenges in applying these advances to improve the quality of being human. Finally, we will provide highlights from this inaugural year of the Awards.

Award Origins

At the turn of the last century, with America deeply enmeshed in the industrial revolution, Sir Thomas Huxley challenged the nation to consider what it would do with all its developing industrial might. A similar question could be posed for our ever-shrinking world in this age of escalating scientific and technological change. What will we do with all this capability and how will our truly marvelous advances be brought to bear on the complex and urgent problems that confront us as a global society?

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In the spring of 2000, a member of the Center for Science, Technology, and Society (CSTS) Advisory Board provided colleagues with the recently completed study of the Millennium Project of the American Council for the United Nations University.[1] Through a systematic process of reiterative data gathering with hundreds of futurists, scholars, business planners, scientists, and decision makers this study developed consensus agreement on fifteen global challenges. The protagonist at the CSTS Board meeting was Doug Engelbart, Turing Award winner and recipient of the National Medal of Technology. Though Doug is best known for his invention of the computer mouse, he is also a pioneer of network computing and numerous other innovations. He is a passionate advocate for what he describes as the "need for technological and human systems to increase their rate of co-evolution" if we are to effectively address complex and urgent problems like those identified in the Mil lennium Project.

In parallel with discussions at the CSTS Board, members of The Tech Museum of Innovation Board were considering the development of a new awards program to recognize the social benefits of technological innovation. What intrigued members of the CSTS Board, as well those on the Tech Museum's Board, was the degree to which technology must be an essential component for a comprehensive solution to nearly all of the Millennium Project issues. Moreover, the phrasing of each issue as a "how" question suggested that these were daunting, but not insurmountable "design" challenges. That is, human agency, or the resolve and ingenuity of individuals and social organizations is, indeed, the pivotal factor in our rising to the most vexing challenges that confront our shrinking world. For example, the report asked:

- *How can* sustainable development be achieved for all?
- *How can* globalization and convergence of information and communications technologies work for everyone?
- *How can* ethical market economies be encouraged to reduce the gap between rich and poor?
- *How can* the threat of new and reemerging diseases and immune microorganisms be reduced?
- *How can* the capacity to decide be improved as the nature of work and institutions changes?
- *How can* growing energy demand be met safely and efficiently?
- *How can* scientific and technological breakthroughs be accelerated to improve the human condition? [2]

The phrase "how can" was well considered by the authors of The Millennium Project report. The work of inventors and innovators tends to be self-organizing around well-defined problem clusters, and this report encourages that these diverse communities of practice place a greater emphasis on the collective problems of our human race. For the socially conscious scientist, engineer, or practitioner, it suggests that the word "how" juxtaposed to urgent social or economic challenges should become a call to action. In fact, for many it *is* the antecedent condition for channeling the creative application of existing technologies, for the invention of new tools, and for scientific breakthroughs to benefit all people. For these individuals, "how" questions at the nexus point of technology and humanity not only challenge the intellect, they connect the head and the heart in imagining and then, brick-by-brick, building a better world.

Recognizing the Intertwining Rope Strands of Science, Technology, and Society

Today, advances in science and technology amplify each other. For example, modern computing tools enabled decoding of the human genome to occur in a much shorter period than originally envisioned. Similarly, advances in imaging technologies are deepening our understandings of the human brain, and bio-informatics is transforming medical research. Conversely, scientific breakthroughs in physics, biology, chemistry, and electrical engineering are spawning advances in nanotechnology, biotechnology, robotics, and communications. Like the strands of a rope, science and technology are becoming more tightly intertwined. While this coupling is contributing to a scientific and technological renaissance, it is also increasing the velocity of change and contributing to cultural lag, straining the adaptive capacities of individuals and organizations.

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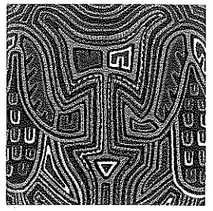
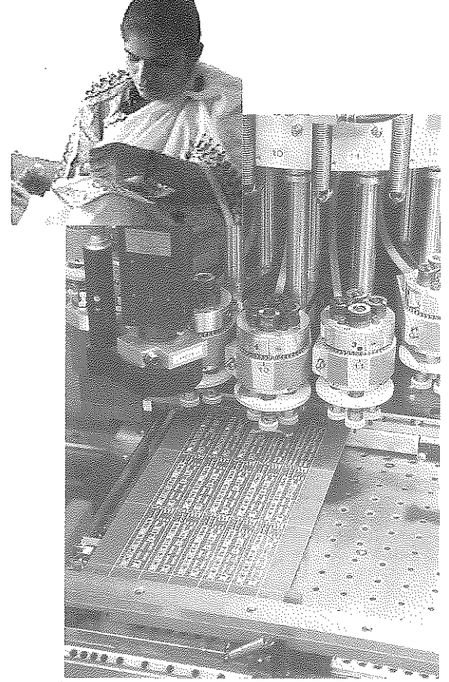




Often less appreciated is the third strand of this metaphorical rope—societal institutions and human values. We should not become so captivated by our marvelous new tools that we fail to fully grasp the challenges and opportunities that they represent when it comes to everyday work of organizations and the dignity and quality of human life. The list of challenges is daunting—from ethical dilemmas in bioengineering, to privacy and the security of globally networked communications, to the potential for transformations in the nature of work to further marginalize the poor. At the same time, opportunities to advance the quality of human life through the creative use of technology have never been greater. Realizing these opportunities, however, requires what Engelbart describes as the co-evolution of human and technical systems. It is clear,scientific advances alone will not lead to mitigating the gap between rich and poor, combating immune deficiencies or solving energy demands. Human, organizational, and institutional capacities for adaptation must also evolve.

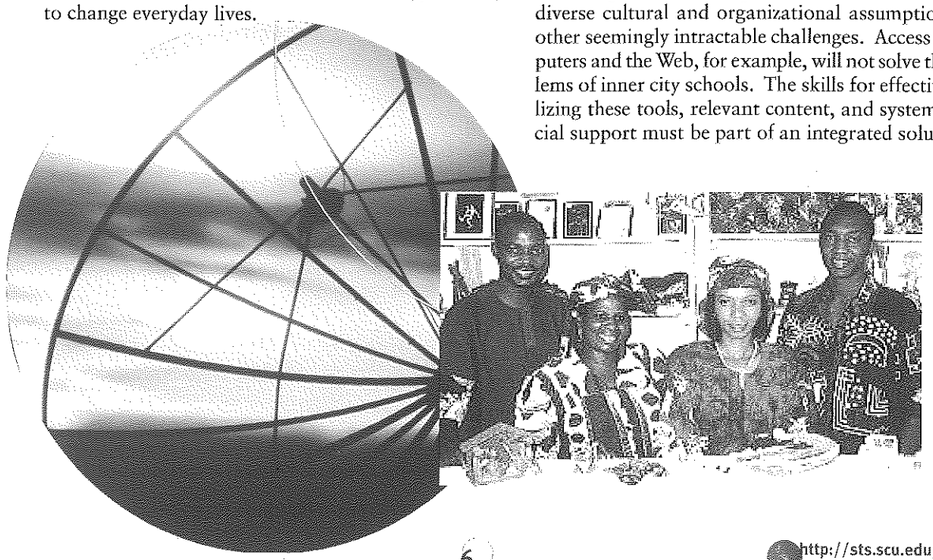
Socio-Technical Views to Improve Humanity

In *Rescuing Prometheus*[3], Thomas P. Hughes examines how the optimal value of advances in science and technology is captured through cycles of invention, innovation in the applications of technology, and adaptive social and organizational change. In particular he describes the role of two key protagonists—independent inventors and system builders. He also underscores that it is not technology, but socio-technological systems that determine the future of technology. Inventors and system builders have complementary roles, and socio-technical perspectives can increase understanding of the process by which technological advances achieve the scale, scope, and broadened applicability to change everyday lives.

The activities of independent inventors and of scientists in research and development labs tend to focus around "clusters of problems" that are defined by peers within well-defined communities of practice[4]. These groups are often referred to as "discourse communities" in the sense that they share a common language and set of epistemological assumptions. Their work entails the application of theory, tireless testing and experimentation, and deep knowledge within a particular scientific or technical area. It is guided by the norms of rigorous investigation, hypothesis testing, and reproducibility that are spelled out by peers.

By comparison, "system builders" are guided by the need to develop capacities for supporting ongoing innovation and extending its scope and impact. They play a vital and complementary role relative to inventors by taking a holistic approach to the more specialized, inventive work of pioneering scientists and engineers. As Hughes suggests, they have a genius for integrating heterogeneous components— physical, human, financial, and organizational— within a goal-oriented system. Their models and practices are constantly evolving. For example, modern program management and systems engineering have enabled the tackling of projects of increasing scale and complexity.

Getting ideas from the mind of the inventor, to integrated systems, to market is not the end of the innovation cycle. For the positive benefits of technology to be realized in human endeavors—from healthcare delivery systems to ecological systems, and from state-of-the-art classrooms to useful applications in third world economies—involves changing old ways and the development of new social architectures to support new practices. This may especially be the case where advances in science and technology are brought to bear on the complex and urgent problems of our global society. Here the assumptions of elite scientific peer groups and designers confront practical resource constraints, diverse cultural and organizational assumptions, and other seemingly intractable challenges. Access to computers and the Web, for example, will not solve the problems of inner city schools. The skills for effectively utilizing these tools, relevant content, and systems of social support must be part of an integrated solution.



The creative appropriation of technology to benefit society presents ground level challenges that can rival the intellectual puzzles addressed in basic research. These challenges require bifocal vision, or the ability to simultaneously comprehend issues of scientific or technological feasibility, as well as the practical concerns of innovation and change in diverse settings. To be sure, the capital investment constraints, physical infrastructure, and cultural norms of an African village differ from the array of challenges in developed urban environments. Similarly, language, poverty, and basic skills vary dramatically across our global society. Those on the periphery are not like their more privileged brethren who are early adapters of modern tools in healthcare, education, or computing and communications.

The Tech Awards recognize how, through human agency, the advances of our scientific and technological age are benefiting humanity. They recognize individuals and organizations that struggle with the challenges of applying advances in science and technology in the complex and "uncontrolled" laboratory of human, organizational, and social change. These agents of innovation recognize that old axiom, "first humans make the tools, then the tools remake what it means to be human," but their work is inspired by the objective of creatively appropriating technology to improve the common good. It takes place at the nexus point of technology and humanism in the five general categories in which The Tech Awards will be granted: Environment, Health, Education, Equality, and Economic Development.

Inaugural Year Highlights

In its first year the Awards achieved many milestones. These included the sizable number, quality, and geographic diversity of the nominees, the creation of a multi-disciplinary and international judging process, and the broad and growing base of support for the Awards.

The Awards recognize achievements in five categories. In this inaugural year there were two hundred and seventeen applications. Fifty of these were in the Health category; fifty-three were in Education; thirty-nine were in the Environment category; thirty-six focused on Economic Development; and, thirty-nine addressed concerns related to Equality. Of the two hundred and seventeen applications, fifty-eight were from individuals, with organizational submissions divided between the one hundred and eleven that came from non-profit entities and forty-eight from for-profit organizations. Applications were received from thirty-six different countries, twenty-three states and the District of Columbia. Clearly, in its inaugural year the *Technology Benefiting Humanity* awards succeeded in becoming truly international in their reach. For a program with no prior record and no institutional visibility this level of response is remarkable.

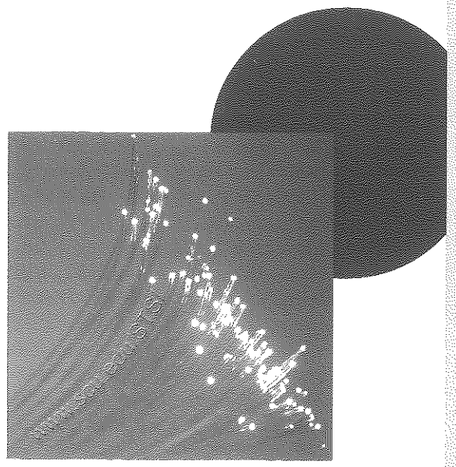
The Judging Process

To create an independent judging process with the capacity to systematically review proposals that spanned the areas of health, education, and equality, as well as the environment and economic development, the Tech Museum of Innovation turned to the Center for Science, Technology, and Society (CSTS) at Santa Clara University. Santa Clara is California's oldest institution of higher learning. As a Jesuit University its mission encompasses the integration of knowledge with a commitment to developing leaders of competence, conscience, and compassion. Its STS Center is unique in its multidisciplinary focus on the interplay of science and technology with culture and society. The Center's capabilities span the disciplines of science and engineering as well as the social sciences, religion and the humanities. In addition, it taps the University's expertise in law and business through its commitment to action research and public policy issues.

Education
Economic Development
Health
Environment
Equality

Five judging panels, one for each award category, were established by the Center. Each panel was comprised of six to eight members and multidisciplinary in its composition. In addition, panels had at least three members who were not from Santa Clara University, but who were selected to broaden the expertise related to a particular award category. These "outside" members were all senior leaders in public or private organizations. They included individuals from Japan, Australia, and Finland, as well as the United States.

Pete Facione, Dean of the College of Arts and Sciences, chaired the Health judging panel. It included the Director of International Business for Alza, a senior policy director from the Association of American Colleges and Universities, as well as a Professor of Medicine and Health Policy from UCSF. Its expertise was rounded out by two Santa Clara University professors from Biology, as well as two from Psychology— one of whom founded and directs a program in gerontology.

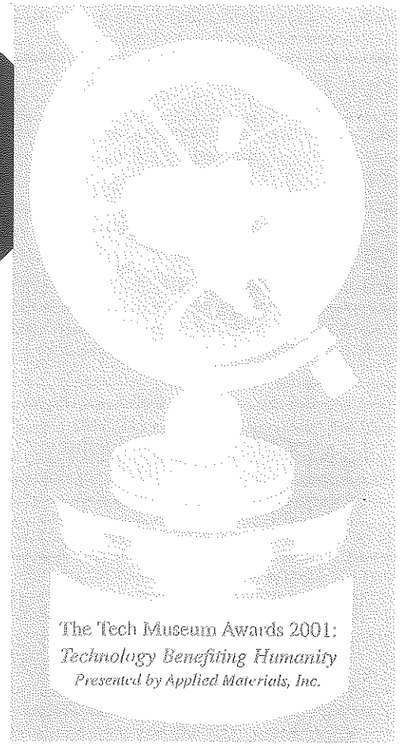


The Education judging panel was headed by Professor Emile McAnany, Chair of Santa Clara's highly respected Communication Department. This panel also included the CEO of Synaptics; the Chairman of Octago and President of Cultural Initiatives; and Finland's Senior Technology Advisor for the National Technology Agency. Three other SCU faculty members rounded out this panel—the Chairman of the Education Department, an Assistant Professor of Education, and an Associate Professor of Communication.

The Environmental judging panel was chaired by Law Professor Dorothy Glancy. It included a member of the United Nations Commission on Human Rights, a corporate vice president for global operations, a chief technology officer, and a senior law partner and co-chair of his firm's environmental practices group. This panel was rounded out with the Director of SCU's Environmental Studies Institute, as well as professors from Law and Communication.

The Economic Development judging panel was chaired by Orradre Professor of Economics Alex Field. It included two other respected economics scholars, one of whom has lived extensively in Africa where he studied the economics of village life. Other panelists included the senior technology officer of Matsushita Electronics in Japan, the CTO of Xilinx, and an angel investor and consultant to technology companies.

The Equality judging panel was headed by Law Professor Al Hammond. Its seven members included a senior technology law scholar from Australia, a respected author and educational media designer, the founder and Chairman of SyberSay, a learning technologies expert, and two additional Santa Clara University professors—one from Computer Engineering and one from Communication.



The specific names and titles for all of our distinguished judges are listed at the end of the articles summarizing the applications considered by each panel. Each panelist worked with a common judging rubric that included consideration of the specific problem being addressed, the innovative nature of the technological approach and its breakthrough application, evidence of contribution and measurable results, as well as potential consequences for humanity and reproducibility. A total, or overall, rating for each application was arrived at by combining scores across the judging rubric and through the exchange of panelist perspectives. Finalists for each category and the top honoree to be named were arrived at through consensus. This approach ensured that each panel would benefit from both independent judgment on common criteria as well as the collective insights of cross-disciplinary peers.

We are truly excited about these Awards. They will illuminate the many ways in which the application of advances in science and technology can improve the quality of life for everyone. Congratulations to the finalists and thank you to all the participants and judges. We look forward with great enthusiasm to the inspiration and education that are part of not only this year's awards, but the future participants as well.

Reflections by Peter Giles, President and CEO, The Tech Museum of Innovation

We believe The Tech Museum of Innovation Awards will reposition the role of technology. Rather than narrowly viewed as a means of creating wealth for a privileged few, we see technology as an agent of hope for many people. The challenges confronting us in the 21st century can seem overwhelming, but if we consider the promise and power of technology, the future seems less bleak. The Tech Museum Awards will share success stories of technological breakthroughs that will inspire other innovators to harness technology to transform the way we live now and for generations to come.

The Tech and its partners and sponsors share a dream of making a difference—by spreading the ingenuity of Silicon Valley throughout the world. The Tech is joined by Applied Materials, Inc., led by Jim Morgan, Chairman and CEO, who stepped forward when our dream was first forming, to inspire others to follow their presenting sponsorship lead. The Nasdaq Stock Market, Knight Ridder, Credit Suisse First Boston, JPMorgan Chase, and Intel committed awards category sponsorships. We are also grateful to Forbes, Inc. and Alexander Ogilvy Worldwide Public Relations who have helped to spread the word of our new awards program to 50 countries around the world. The Tech Awards will show how much we can accomplish if we work together in service of humanity.

Reflections by Paul Locatelli, S.J., President, Santa Clara University

The Internet is the fastest growing technological phenomenon in history, but to benefit humanity it must reach all valleys and mountains, deserts and forests where people live. For example, how can the nations of Africa benefit if less that 1% of its population has access. Or, how can the people of Latin America benefit when 40% cannot read or write?

Advancing at sometimes surreal speed, technology presents us with both great opportunities and risks. The challenge for leaders in our increasingly global village is developing and using technology's scientific and market potential while at the same time addressing its complex ethical and justice dilemmas. For all of us, the challenge is to improve and learn with it, but also to critique it and insure that its potential to make the world more humane is fully realized.

If we could shrink the earth's population to a village of precisely 100 people, with all the existing human ratios remaining the same, it would look something like this: 80 would live in substandard housing, 70 would be unable to read, 50 would suffer from malnutrition, 1 would have a college education, and 1 or 2 would own a computer.

The opportunity for modern science and technology to benefit our global human village is enormous. Whether it is in education, health, the environment, equality, or economic development, the potential is there to overcome the inequalities between rich and poor and improve the quality of life. Only then will justice and the common good be advanced for all.

These awards recognize the innovative contributions of the people whose work will benefit humanity. By highlighting their work, we honor them and call attention to the importance of the creative imagination in developing and applying technological tools to address the pressing problems we face in our world. I hope this awards program will encourage others to understand how challenging and fulfilling it is to advance technology not merely for its own sake but to make the world a more humane place for all. Santa Clara University is pleased to be a part of this awards program.

References

[1] Jerome C. Glenn and Theodore J. Gordon. *State of the Future at the Millennium* (Washington, D.C.: American Council for the United Nations University, 2000).

[2] Jerome C. Glenn and Theodore J. Gordon. *State of the Future at the Millennium* (Washington, D.C.: American Council for the United Nations University, 2000).

[3] Thomas P. Hughes. *Rescuing Prometheus* (New York: Pantheon Books, 1998).

[4] Thomas P. Hughes. *Rescuing Prometheus* (New York: Pantheon Books, 1998).

About the Author

James L. Koch is Director of the Center for Science, Technology, and Society, and Professor of Management at Santa Clara University. He received his MBA and Ph.D. from UCLA. From 1990-96 he served as Dean of the Leavey School of Business and Administration. In 1995 the School achieved national recognition by U.S. News and World Report as the 12th ranked part-time program in America. From 1981 to 1990 he was Manager of Organization Planning and Development at PG&E, where his department was the recipient of the National Excellence Award for contributions to organizational development from the American Society for Training and Development. Prior to that he was Associate Professor of Management and Director of the MBA and Ph.D. Programs at the University of Oregon. While at Oregon he was elected a Danforth Fellow for his contributions to humanizing the teaching and learning process. His research and consulting have focused on socio-technical systems and high performance organizations. His current work examines information technology and organizational change, social capital, and the psychological sense of community in the workplace.

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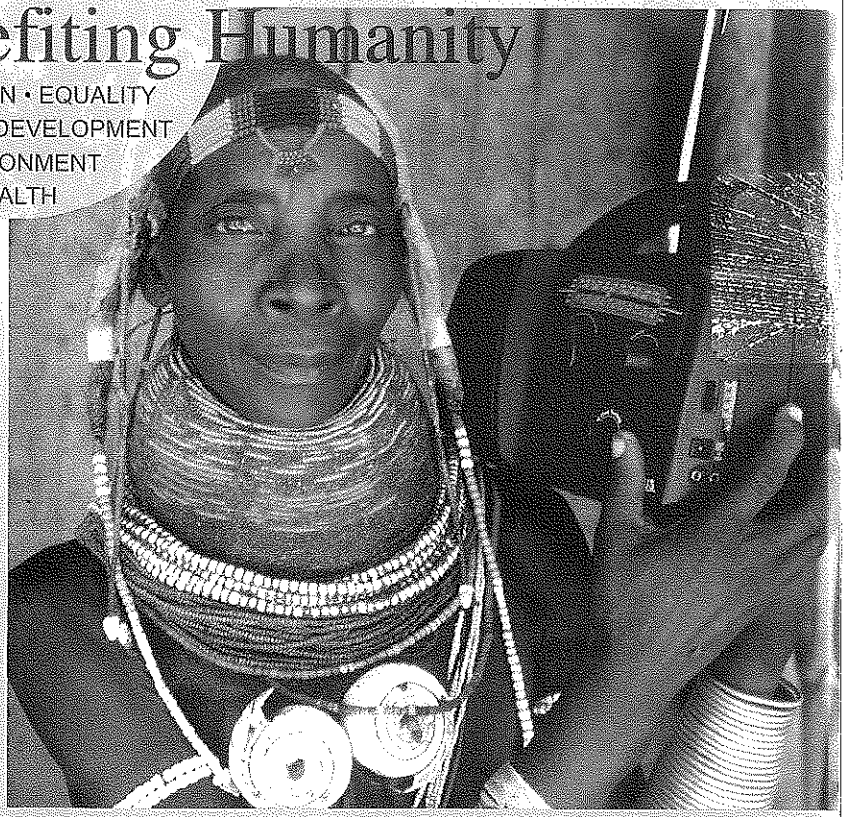
THE TECH MUSEUM AWARDS

Technology Benefiting Humanity

EDUCATION • EQUALITY
ECONOMIC DEVELOPMENT
ENVIRONMENT
HEALTH



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