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# Equality as an Issue in Designing Science, Technology, and Innovation Policies and Programs

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# Equality as an Issue in Designing Science, Technology, and Innovation Policies and Programs

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Inequality is an important global challenge. Inequalities between countries are growing. While some poor countries are rapidly expanding their economies, others are stuck at a low level and the gap is therefore widening between countries. Inequality is also growing within many countries, including affluent ones. Inequalities in basic needs such as food and water violate human rights as identified by the international community.

An inequality is a barrier – a steep differential that someone must scale to achieve his or her full potential. Human progress as a whole is therefore hampered by inequalities, which keep our efforts from adding up to all they could. This happens through vertical inequalities, differences between individuals and households generated by the structure of the economy, and through horizontal inequalities, differences by culturally-defined categories like gender, ethnicity, and religion.

Why talk about inequalities in the context of science, technology, and innovation (STI) policies? On the one hand, STI policies link directly to basic needs, when they deal with food, health, and the environment – all topics that are virtually universal on national STI policy agendas. On the other hand, STI policies link indirectly to inequalities in income when they affect the dynamics of economic growth. STI policy practitioners think of their work as providing a public benefit, but any public intervention can contribute to cumulative advantage if it is more accessible to the members of society who have greater resources. Public interventions, including STI policies and programs, need to be specifically designed to reach disadvantaged groups if they want to be redistributive.

My colleagues and I distinguish three types of redistributive policies: (1) Pro-poor policies aim to reduce poverty or alleviate its conditions. (2) Fairness policies work on eliminating horizontal inequalities, e.g. by gender or race. (3) Egalitarian policies attempt to reduce vertical inequalities, through economic activities that increase income for people in the middle of the distribution. I illustrate each type here, drawing on a mix of research, human resource, and innovation policies from the STI realm.

**Pro-Poor Interventions**

A first example comes from research my team is doing on innovation in water supply and sanitation in developing countries. The core of the problem is provision of these basic services to very poor urban and rural communities, and both government agencies and non-governmental organizations try to target their efforts to those areas. Poor sanitation and bad water are serious health problems, and bad health holds back development. Interdisciplinary research, involving social scientists as well as engineers, is helping to help make those programs more effective.

A second example concerns access to essential medicines. Patent policies have been designed in affluent countries to allow companies to recoup the high costs of developing new research-intensive products like drugs. Under patents, companies can charge high prices for new products. In Europe and the U.S., this is not a problem for poor people, who get access through public programs. But in low-income countries, the price stands between the drugs and those who need them. In relation to HIV/AIDs drugs, an international coalition of civil society organizations took action, negotiating a much lower price with generic producers in India. Unfortunately, recent developments in international regulations have undermined this solution, and the search is on for other creative approaches.

Another example comes from the research agenda for African agriculture. On any map of world hunger, Africa stands out; and most of the hungry people in Africa are subsistence farmers living on the land. International agricultural research is therefore targeting the search for locally helpful strains to improve yields for these families. Community-based innovation is also being tapped, since local farmers know their own crops and conditions best.

**Fairness interventions**

Fairness interventions can be illustrated both within and outside the pro-poor approaches. Water supply and sanitation in poor communities in the developing world is a women's issue. Women fetch and carry water when it is not available at the home, and girls stay away from school when sanitation arrangements are not adequate. Public interventions in this area are explicitly trying to make sure that women's voices are heard, and women are providing leadership in community-based technological choices.

In a very different context, U.S. research policy offers several examples of fairness interventions. The Women's Health Initiative at the National Institutes of Health has focused both on getting more women into careers in biomedical research, and on developing a research agenda that focuses on the female experience. Similarly, the U.S. has a number of program devoted to reducing health disparities, which underlie the still-large difference in life expectancy between African- and European-Americans. The health disparity programs also have strong human resource elements, trying to attract more African Americans into science careers, but they also invest in building institutional capacity in historically black medical schools and are linked to community-based research.

A final example comes from the other side of the world. Maori research policy has been established under the framework of the treaty between indigenous and newcomer New Zealanders. Research that involves the Maori community must be "by Maori, for Maori, and working from a Maori world-view" – strong local control.

**Egalitarian interventions**

Finally, we have a number of examples of the egalitarian interventions, those that decrease inequality by changing the shape of the economy. Technology-based local economic development efforts fall into this area. In the U.S., the Experimental Program to Stimulate Competitiveness in Research (EPSCoR) illustrates. The federal program provides funds for local plans to develop human resources and institutional capacity in research and link it to the local economy.

In other well-known examples, industrial policy has been used. Korea, Finland, and Ireland have all achieved dramatic growth by adding large numbers of middle-wage jobs to an economy in export industries. The rapid expansion reduces unemployment to a minimum, and thus cuts into poverty directly.

Strategies for rural development likewise reduce the difference between urban and rural living. Examples from STI policy include bringing the Internet to the countryside, commercializing rural innovations like fish-drying techniques on the coast of Kerala, India; and encouraging rural entrepreneurship, like the pump-repairing businesses that can follow in the wake of rural water supply projects, increasing sustainability of the pumps themselves and building skills in the local workforce.

**Design principles**

The three different kinds of programs described above each involve a different set of people and thus call for distinctive design principles and processes, as well as particular attention to implementation, evaluation, and assessment with involvement of the groups they are intended to benefit. These apply to all STI policies, including those designed to benefit marginalized groups.

The pro-poor interventions involve people living at the edge of subsistence. They know their living conditions and personal challenges better than any outside experts and they have often invented creative alterations in technologies to match their own needs and resources. What they generally lack, however, is the technical expertise to keep a technology effective even if it is altered. All these characteristics suggest strongly that pro-poor interventions should combine the inventiveness of poor communities with the problem-solving skills of scientists and engineers. Without community participation, the scientists and engineers are unlikely to find appropriate solutions on their own. Programs that build the marketable skills of community members are also the most valuable.

Fairness interventions similarly require development through a feedback process that incorporates the experience of program participants. These programs target previously disadvantaged groups, but their goal is a research and innovation enterprise in which everyone feels welcome and can achieve their best. Empowerment is an essential element to readjust previous relationships. If the programs do not address the cultural ideas that created the original inequality, they will leave unequal structures in place even while they change the occupants of privileged positions.

Design principles for the egalitarian programs focus on finding the economic opportunity that matches a country or region's capabilities. The chance for rapid expansion is probably a rare occurrence as compared with incremental growth. These efforts must also keep the other re-distributive goals in view. Korea unfortunately built its export competitiveness based on large wage differentials between male and female workers – not a model for other countries to follow.

In summary, inequality-reducing options are available in STI policy. Expanding efforts to reach disadvantaged groups will make a difference over the long run in the distributional consequences of this set of policies.

**Redistributive STI Policies**

| | Goal | Examples | Design Principles |
|---|---|---|---|
| **Pro-poor** | Reduce poverty or alleviate its conditions | • Focused water innovation programs<br>• Negotiated low prices for essential medicines<br>• Community-based innovation in African agriculture | Combine the inventiveness of poor communities with the problem-solving skills of scientists and engineers |
| **Fairness** | Eliminate horizontal inequalities, e.g. by gender or race | • Women leading water programs<br>• Women's Health Initiative<br>• Minority Health Initiative<br>• Maori research policy | Empowerment to readjust previous relationships |
| **Egalitarian** | Reduce vertical inequalities; grow the middle of the income distribution | • EPSCOR<br>• Industrial policy<br>• Rural innovation programs | Match local capabilities with wider opportunities. Keep the other goals in view |