



Distributional Assessment of Emerging Technologies: A Framework for Analysis

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There is an intense global debate about rising global inequality within and between nations. The ResIST project is examining the role of science and technology in the construction of inequality, and the scope for new science and technology policies that might remedy such inequality and promote more inclusive growth.

Innovation policies, research policies and human resource policies might all have a part to play in such a new approach. *Innovation policies* that encourage the introduction of new products and processes claim to contribute to economic growth for particular regions or countries through the monopoly rents the innovations command, a process that some see as favoring countries that are already affluent. *Research policies*, which encourage the production of new knowledge, increasingly emphasize adjusting research agendas to the needs of innovating industries, and are thus more and more implicated over time in the inequalities that innovation produces. Yet because research policies are set in the public sphere, they are also often the object of attempts by disadvantaged groups to increase knowledge about solutions to their own problems. *Human resource policies*, which attempt to assure an adequate supply of scientists and engineers for an innovating economy, are caught in the tension between egalitarian domestic objectives and the need to compete for top talent on a global market.

This paper focuses on the distributional consequences of *emerging technologies*, a place where research and innovation policy meet. Emerging technologies are important because many countries in the developing world try to develop capacity in these areas in order not to be left out of global technological change; because there are reasons to think that such technologies increase inequalities; and because it may be that early intervention may change these distributive effects.

The paper combines hypotheses on the consequences of emerging technologies for inequalities into a qualitative model that can be used to analyze specific situations. The immediate goal is to think carefully enough about the connections between emerging technologies, public and private policies, and a variety of inequalities to be able to study those connections. Our ultimate goal is to develop options for decision makers in the private and public sectors to help emerging technologies reduce rather than increase inequalities.



The qualitative model we are trying to build has four variables:

Technological projects: This is a term that we introduce to avoid reifying the characteristics technologies take. Different technologies have different distributional consequences and these vary with the pattern of interaction with and between developers, investors, markets and regulators. Technological projects are the independent variable in our model. They are often, but not always, initiatives of the private sector. ***Our first general hypothesis is that technological projects are always inherently distributional, and that the distributional aspects of individual projects and portfolios of projects are open to choice.***

Distributional consequences: the effects of the technologies on inequalities in the distribution of things people value - income, health, education, social capital, cultural expression or political power. These inequalities can be found both within countries and between countries, and can arise as a result of a country being the site of invention, production or consumption of a technology. Within a country they can show as either *vertical inequalities* - differences in the distribution of income or other valued items, like health, whose distribution is income related, or *horizontal inequalities* - differences in the distribution of valued items that occur between culturally defined groups, such as genders, ethnicities and regions. Distributional consequences can be seen as the dependent variable of our model.

National characteristics and public interventions are the mediating or intervening variables in our model. *National contexts* vary in their industrial structures, urbanization, educational levels, economic inequality etc. ***In different national contexts, we hypothesize that the same technological project will have different distributional consequences, even under similar policy circumstances.***

Public investments and decisions stimulate and shape technology in the private sector in important ways. Because emerging technologies draw on a science base, public research efforts are often an important element of the environment that stimulates and supports firms to develop them, and those efforts can be directed to technologies that benefit the poor in particular. Public policies may provide incentives for research and development in private firms, or complementary investments for the location of production facilities, policies which can have distributional consequences. We see public interventions in S&T policies as embodying four broad distributive approaches:

- *utilitarian approaches*, which focus on using science and technology to increase economic growth without specific attention to assuring that the benefits of growth are distributed widely;
- *pro-poor approaches*, targeted to reducing poverty or conditions associated with poverty, eg AIDS
- *equalizing approaches*, aimed at reducing vertical inequalities, eg by creating middle-income jobs;
- *egalitarian approaches*, aimed at reducing horizontal inequalities, for example, by leveling the playing field for historically disadvantaged groups.

A third general hypothesis is that the same technological project will have different distributional consequences, even under similar policy circumstances.

The extent to which distributional consequences beyond the control of S&T policies and programs will be pursued through ResIST's later empirical work. At present we can only define in broad terms the areas in which the distributional consequences of new technologies might be shaped:

Consequences of technology x...

| | In this dimension: | |
|------------------|--------------------|--------------|
| Associated with: | - Vertical | - Horizontal |
| - Invention | | |
| - Production | | |
| -Consumption | | |

The paper concludes with a more detailed discussion of the concepts used in the model and some tentative suggestions of possible implications for policy.