Table D2. Returns in Agricultural Growth and Poverty Reduction to Investments and Subsidies, India, 1960-2000

	1960s		1970s		1980s		1990s	
	Returns	Rank	Returns	Rank	Returns	Rank	Returns	Rank
Returns in Agricultural GDP (Rs produced per Rs spent)								
Road investment	8.79	1	3.80	3	3.03	5	3.17	2
Educational investment	5.97	2	7.88	1	3.88	3	1.53	3
Irrigation investment	2.65	5	2.10	5	3.61	4	1.41	4
Irrigation subsidies	2.24	7	1.22	7	2.28	6	na	8
Fertilizer subsidies	2.41	6	3.03	4	0.88	8	0.53	7
Power subsidies	1.18	8	0.95	8	1.66	7	0.58	6
Credit subsidies	3.86	3	1.68	6	5.20	2	0.89	5
Agricultural R&D	3.12	4	5.90	2	6.95	1	6.93	1
Returns in Rural Poverty Reduction (decrease in number of poor per million Rs spent)								
Road investment	1272	1	1346	1	295	3	335	1
Educational investment	411	2	469	2	447	1	109	3
Irrigation investment	182	5	125	5	197	5	67	4
Irrigation subsidies	149	7	68	7	113	6	na	8
Fertilizer subsidies	166	6	181	4	48	8	24	7
Power subsidies	79	8	52	8	83	7	27	6
Credit subsidies	257	3	93	6	259	4	42	5
Agricultural R&D	207	4	326	3	345	2	323	2

Source: Fan, Gulati, and Thorat 2008.

As shown in Table D2, most public expenditures to agriculture in the 1960s generated very high returns to both agricultural growth and poverty reduction. During this period, India's green revolution was just starting to take hold, which might make this period particularly relevant for many African countries. Particularly high returns were generated from public investments in roads and education, which had estimated benefit-cost ratios of 6 to 9. Agricultural research investments and credit subsidies yielded benefits that were 3 to 4 times the amount spent. This was the period when improved seed varieties, fertilizer, and credit were being promoted as a high payoff technology package. Irrigation and power subsidies yielded the lowest returns in this period, though returns to these subsidies were more than double spending. In the 1970s and 1980s, the returns to most of the subsidy programs declined though they began to account for a growing share of national budgets. Meanwhile, investments in agricultural R&D, roads, and education provided the greatest payoffs in terms of agricultural growth. By the 1990s only agricultural R&D and road investments continued to yield estimated returns of more than 300%. Estimated net returns to irrigation investments and education were low but still positive, whereas credit, power, and fertilizer subsidies had negative net returns, i.e., a Rupee invested generated less than one Rupee of benefits (Fan, Gulati, and Thorat 2008). These findings are similar to those of Rashid et al. (2007) who concluded that state subsidies in input and output markets played an important role in supporting the initial uptake of improved farm technologies in Asia, but that their return fell

over time and that the subsidies have now become a major drain on the treasury while crowding out other public investments that could produce higher payoffs.

The ranking of public investments in terms of poverty reduction follow the same broad pattern as that for agricultural GDP growth. Spending on roads, agricultural R&D, and education provided the greatest poverty reduction impacts. These findings are consistent with evidence from Africa showing returns to investment in agricultural R&D over 20% per year (Oehmke and Crawford 1996; Masters, Bedingar, and Oehmke 1998). The economic assessment evidence strongly indicates that if the resources that were spent on crop science had been spent on something else, African economies would now be poorer, government finances would be in worse shape, food import bills would be higher, and more Africans would suffer from food insecurity.

Fertilizer subsidies are estimated to have been effective at reducing poverty in the 1960s and 1970s, but subsequently appear to have been highly ineffective (Table D2). Credit subsidies were effective in the 1960s and 1980s. As stated by Fan, Gulati, and Thorat (2008), "These results have significant policy implications: most importantly, they show that spending government money on investments is surely better than spending on input subsidies. And within different types of investments, spending on agricultural R&D and roads is much more effective at reducing poverty than putting money in, say, irrigation" (p. 18-19).

The findings of these two studies from Asia provide potentially important implications for promoting agricultural growth and poverty reduction in Africa. Although the regions differ in important respects, there are strong reasons to believe that the policy reforms and investments in R&D and infrastructure that generated high payoffs in Asia are likely to be crucial drivers of growth in most of Africa as well. The payoffs to most types of public investments will be greater in a policy environment conducive to private investment. As concluded by EIU (2008): "Our assessment is that the interventions that proved most effective in Asia—policy and institutional reforms, an agricultural research revolution, major expansion of rural roads and irrigation, and improved rural financial services delivery—must likewise be the primary targets for new investments…..The specifics of the strategies will vary among countries and even among agro-ecologies within countries, and must be developed internally, albeit with external financial and technical assistance. But the broader patterns are clear" (p. 18).
The main caveat to these studies is that they are based on the period 1960-2000. Much has changed since then. Global climate change, constraints and costs associated with bringing new land into production, higher energy prices, the evolving structure of the global food system, the concentration of agricultural R&D research and increasing intellectual property right protection barriers to public R&D, Africa's increasingly urban complexion, and the possible slow-down of crop productivity growth in the world's breadbasket zones are several of the most important developments that would need to be carefully considered which might alter, perhaps fundamentally, the way relative payoffs to public sector investments in the future and the nature of the CG research priorities.