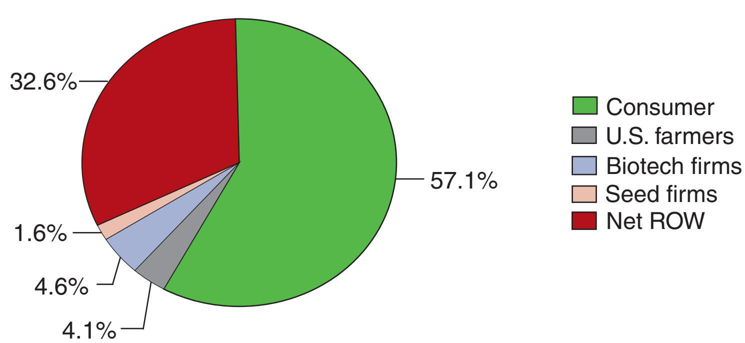
Adoption Offers Market Benefits to Many Stakeholders

In addition to farmers, seed suppliers, technology providers, and consumers also benefit from the adoption of GE crops in the United States. Biotechnology developers and seed firms benefit by charging technology fees and seed premiums to adopters of GE varieties. U.S. and foreign consumers may benefit indirectly from GE crops through lower commodity prices that result from increased supplies.[13]

ERS estimated the total market benefit arising from the adoption of three GE crops in the United States—HT soybeans, Bt cotton, and HT cotton—in 1997 (Price et al., 2003).[14] Estimated benefits to farmers, seed producers, and consumers were around $210 million for Bt cotton, $230 million for HT cotton, and $310 million for HT soybeans. This estimate includes the change in total welfare in both the seed input and commodity output markets. The distribution of these benefits among consumers, farmers, technology providers (biotech firms), seed firms, and consumers and producers in the rest of the world (ROW) is shown in figures 10-12. The distribution of benefits varies by crop and technology because the economic incentives to farmers (crop prices and production costs), the payments to technology providers (biotech firms) and seed firms, and the effect of the technology on world crop prices are different for each crop and technology. For example, adoption of HT cotton benefits mainly consumers while Bt cotton benefits farmers and technology providers. Seed firms are by far the largest beneficiaries in the case of soybeans.

These results should be interpreted carefully, since the estimates are based on only a few years of data. Moreover, estimated benefits and their distribution depend particularly on the analytical framework, supply and demand elasticity assumptions,[15] crops considered, and year-specific factors (such as weather). In particular, the benefits attributable to HT soybeans and their distribution are very dependent on the soybean supply elasticity. Table 6 shows estimates of the benefits of Bt cotton and HT soybeans and their distribution obtained by other researchers.

Figure 10
Stakeholders' shares of the estimated total world benefit from adopting herbicide-tolerant cotton, 1997



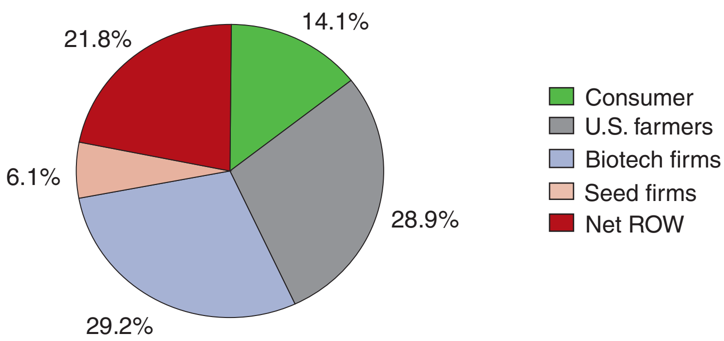
Source: Price et al., 2003.

[13]Consumers may also benefit directly when GE products of the second and third generation are commercialized.

[14]The study estimated the economic gains for various stakeholders associated with adoption by incorporating the potential yield enhancements and savings in pest control costs into models that derive each crop's supply shift resulting from biotechnology. Given domestic and export demands, counterfactual world prices and quantities demanded of the commodities—those that would have prevailed in the market if biotechnology had not been introduced—are determined from market equilibrium conditions. Producer and consumer surpluses in the U.S. and international markets and monopoly profits accruing to the biotech developers and seed firms are then calculated (Price et al., 2003).

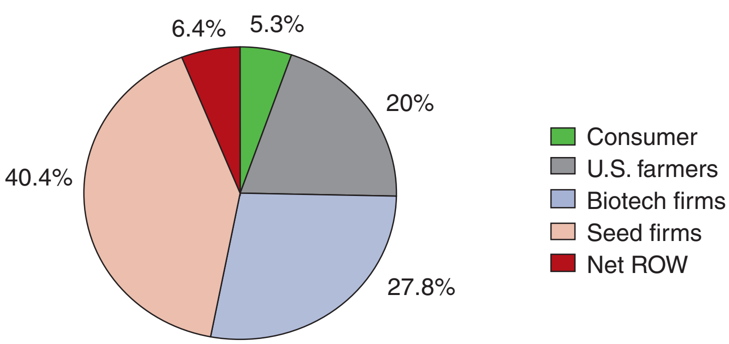
[15]Elasticity measures the responsiveness of one economic variable to a change in another (e.g., price and quantity demanded). It is unit free and always expressed in percentage terms.

Figure 11
Stakeholders' shares of the estimated total world benefit from adopting Bt-cotton, 1997



Source: Price et al., 2003.

Figure 12
Stakeholders' shares of the estimated total world benefit from adopting herbicide-tolerant soybeans, 1997



Source: Price et al., 2003.

Table 6
Benefits of GE techniques and their distribution (from estimates in related studies)

Study	Year	Total benefits	Share of the total benefits			
			U.S. farmers	Innovators	U.S. consumers	Net ROW
		$ million	*Percent*			
Bt cotton						
Falck-Zepeda et al. (1999)	1996	134	43	47	6	
Falck-Zepeda et al. (2000b)	1996	240	59	26	9	6
Falck-Zepeda et al. (2000a)	1997	190	43	44	7	6
Falck-Zepeda et al. (1999)	1998	213	46	43	7	4
Frisvold et al. (2000)	1996-98	131-164	5-6	46	33	18
EPA (2000)[1]	1996-99	16.2-45.9	n.a.	n.a.	n.a.	n.a.
Price et al. (2003)	1997	210	29	35	14	22
Herbicide-tolerant soybeans						
Falck-Zepeda et al. (2000a)	1997-Low elasticity[2]	1,100	77	10	4	9
	1997-High elasticity[3]	437	29	18	17	28
Moschini et al. (2000)	1999	804	20	45	10	26
Price et al. (2003)	1997	310	20	68	5	6

n.a. = Not applicable.
ROW = Rest of the world.
[1]Limited to U.S. farmers.
[2]Assumes a U.S. soybean supply elasticity of 0.22.
[3]Assumes a U.S. soybean supply elasticity of 0.92.
Source: Price et al., 2003.

Conclusion

The role that biotechnology plays in agriculture in the United States and globally depends on a number of factors and uncertainties. As the USDA Advisory Committee on Biotechnology and 21st Century Agriculture report indicates, "agricultural biotechnology sits at the crossroads of other debates on the future of American and world agriculture, on international trade relations, on biological diversity and the development of international instruments related to its preservation and exploitation, on the role of the multinational corporations, and on how best to build public confidence in rapidly evolving emerging technologies in general" (p.2.). One thing seems certain, however: the ultimate contribution of agricultural biotechnology will depend on our ability to identify and measure its potential benefits and its risks as well as their distribution.