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Food security and the evaluation of risk

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ABSTRACT

Achieving global food security over the next 40 years will require sustained increases in agricultural productivity. This will require increased investment in agricultural R&D. If there are systemic reasons why agricultural R&D is inhibited, they warrant investigation. New products and technologies require regulatory approval if they are to be commercialized. Approval, or not, is based on risk assessment with only those products that pass the risk assessment contributing to productivity improvements. If the likelihood of meeting the acceptable risk threshold is reduced, investment in R&D will be negatively impacted. This paper investigates the changing methods of risk assessment for agricultural products and notes a deterioration in the likelihood that risk assessment exercises will be completed successfully. Genetically modified products are used as an example. The changing nature of risk assessments is found to be inhibiting international market access, reducing trade and, hence, making investments in productivity enhancing technologies in agriculture less interesting. Achieving future food security goals will be more difficult.

1. Introduction

There are hundreds of millions of people that currently do not enjoy an acceptable level of food security. Furthermore, there are serious challenges involved in feeding more than 9 billion by 2050 (Beddington, 2010; Evans, 2009). FAO's Deputy Director-General suggested that "agricultural production needs to increase by 70% worldwide, and by almost 100% in developing countries, in order to meet growing food demand" (Tutwiler, 2011).

As global populations expand, ensuring that enough food is available and affordable requires that productivity in food production keeps pace. Otherwise there will be more individuals chasing ever scarcer food – leading to higher prices, lower availability and food insecurity for some. Ultimately if the Malthusian Trap is to be avoided, agricultural productivity must increase (Alston et al., 2009). Meanwhile, there is considerable evidence of serious underinvestment in agricultural R&D over recent decades (Alston et al., 2009; James et al., 2008). Even if investment could be increased to eventually backfill the current shortfall, there are considerable lags – often in the 25-year plus range – between when investments are made and productivity increases are fully manifest (Alston, 2010).

Many reasons exist for underinvestment in agricultural research, including governments' fiscal difficulties (Gaisford et al., 2001); the inability to capture full benefits (Alston, 2002); misaligned incentives (Malla and Gray, 2005); resistance to technological change (Haggui et al., 2006); poor intellectual property protection (Cardwell and Kerr, 2008); high costs in identifying and acquiring existing intellectual property (Smyth and Gray, 2011); and long and costly regulatory processes for new technologies (Smyth et al., 2004).

One further factor that can negatively impact investments in productivity-enhancing technologies is the risk assessment process. Prior to commercial production, products must be judged to pose a sufficiently low degree of risk to be acceptable to society (Phillips et al., 2006). Over the last 20 years the process of risk assessment has been evolving and diverging geographically. The major spur for the diverging treatment has been agricultural biotechnology (agbiotech). The rift over agbiotech is often portrayed as a disagreement between the EU and the US and, while they have been major champions of the divergent approaches to risk, the rift has global implications for investments in agricultural technologies and food security (Isaac and Kerr, 2007a; Barrows et al, 2014).

An increase in the likelihood that a new product or process will not be considered safe enough to be commercialized will reduce the appetite – both public and private – to make the required investment (Smyth et al., 2014). The higher the probability of failing to reach an acceptable level of risk, the smaller the expected benefits will appear to be and less investment will be made (Kerr and Yampoin, 2000; Gaisford et al., 2002, 2007). Similarly, if part of a market has a reduced likelihood of achieving an acceptable level of risk, the expected benefits are reduced

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(Gaisford et al., 2001). All of this inhibits investment in R&D, reducing the rate of technological change just when it is most needed to ensure food security (Smyth et al., 2011). While agbiotech has been the major force behind changes in risk evaluation, this paper tries to make a broader point: once new methods of risk assessment are accepted there is an increased chance that they will be applied to other agricultural innovations, which could jeopardize efforts to address food security. We will use many examples from biotech, but these are just examples – the objective of the paper is not to focus on GM-policy in the EU. Rather, future food security requires we look at all the impediments to higher agricultural productivity, one of which is the risk assessment process facing new technologies.

2. International scope of science-based risk assessment

International risk management strategies have been grounded in science to ensure that risk assessments (and their processes) are not used to distort trade. While no international institution has the mandate to govern biotechnology, there are several with the mandate to govern risks related to agriculture. Four international institutions have staked claims to regulating the food safety and environmental health of products developed from biotechnology. Science-based governance underpins these institutions: the World Trade Organization (WTO); the Codex Alimentarius Commission (Codex); The World Organization for Animal Health (OIE); and the Secretariat of the International Plant Protection Convention (IPPC).

The WTO does not establish regulations governing agbiotech, but it does adjudicate disputes. A nation that enacts a regulation that contravenes the standards of Codex, the OIE or the IPPC can be subject to a WTO member filing a claim that the standard is an unfair trade barrier. The Agreement on Sanitary and Phytosanitary Measures (SPS) of the WTO establishes the use of science as the decision-making criteria for justifying barriers to trade to protect the environment or human, animal and plant health. The SPS specifies that: (1) standards which conform to international (i.e. Codex, OIE, IPPC) norms are consistent with the SPS; (2) standards that are in excess of international standards or where no international agreement exists must be based on scientific principles and the completion of a scientific risk assessment.

If, for example, an International Standard for Phytosanitary Measures (ISPM) established by the IPPC allows for a trade barrier, then every member country of the WTO is allowed to implement this standard without fear of challenge. If a WTO member implements a standard that contravenes the internationally-agreed standards, then that country may be accused of using a disguised trade barrier. Countries may have higher standards than those of an international organization, but only if there is a scientific justification and a risk assessment that satisfies SPS commitments.

The IPPC is a treaty that protects natural flora, cultivated plants and plant products from the spread of pathogens through international trade. It provides a forum for cooperation and technical harmonization. Regulating genetically modified (GM) crops has been addressed though several ISPMs. The IPPC's most important role in trade policy is through the SPS Agreement which accepts the IPPC standards as the basis for evaluating WTO disputes. National measures based on IPPC standards are not open to a WTO challenge.

Codex develops international standards for processed foods including additives, potential contaminants, hygiene, labeling requirements and the scientific procedures used for sampling and analysis. Upon a standard being adopted at Codex, countries are encouraged to incorporate it into domestic rules, but countries may unilaterally impose more stringent food safety regulations, provided the different standards are scientifically justifiable. Codex standards are acknowledged in the SPS and Technical Barriers to Trade (TBT) Agreements of the WTO. There has been significant effort to develop a standard for the labeling of food products derived from biotechnology. The Codex Committee on Food Labeling, after nearly 20 years, in 2012 adopted the principles for a risk analysis of foods derived from biotechnology. It established that labeling is an appropriate strategy for managing identifiable risks. Codex stresses that any risk analysis of biotechnology-derived foods has to be science-based and that any assessment not address "environmental, ethical, moral and socio-economic aspects" (Codex, 2012, p. 1). It is important to note that this is a Codex principle on risk analysis of foods derived from biotechnology and not the standard on the labeling of GM foods that the Committee was tasked with 20 years ago.

In addition to these international institutions, the Organisation for Economic Cooperation and Development (OECD) has, since 1995, actively assisted in the international harmonization of regulatory requirements, standards and policies related to biotechnology. The OECD has worked toward more transparency to facilitate trade in agbiotech products. It develops Consensus Documents that set out the biology of crops, introduced traits, or gene products to provide a common basis for various national regulatory assessments of agri-food products derived from biotechnology. These Consensus Documents contain the technical knowledge that is utilized in the risk assessment of agbiotech products. These mutually recognized documents are increasingly embedded in national regulations.

Risk evaluation systems in modern market economies have been scientifically-based processes that combine the identification and characterization of hazards with assessments of exposure to characterize risk (FAO, 2012; Powell, 2000; Lammerding and Paoli, 1997). The practice is that governments establish a risk threshold that rejects new products with unacceptable risks but allow those with acceptable impacts (Jackson, 2014; Ryan, 2014; Beckmann et al., 2014).

Traditional assessment theory suggests that risk is a combination of exposure and hazard; that is the level of adverse effects of the agent on other organisms (NRC, 1983). This can be expressed as

$$\text{Risk}^{\text{scientific}} = \text{Hazard} \times \text{Exposure}$$

Scientists use this formula to evaluate whether initial research should proceed or be halted, providing the scientific basis for evaluations. If an assessment's level of risk was determined to be higher than what was accepted as scientifically safe, government agencies would not approve the technology or product. While the hazard would appear to be objectively derived through risk assessment by the global scientific community, the acceptable levels and the estimated relative level of risk for a product could vary widely between intended uses.

There has been significant effort put into understanding the divergence between objectively assessed risks (the original science-based model) and socially constructed risks. Sandman (1994) believes that the original formula underestimated the perceived level of risk because it ignored the public response to a risk, which he termed 'outrage'. He argues that regulators should use the following formula for understanding consumer perceptions of risk:

$$\text{Risk}^{\text{socially constructed}} = \text{Hazard} \times \text{Outrage}$$

Sandman (1994) suggests that public concern is focused on whether the risk is acceptable rather than on the scientifically perceived incidence of that risk. While the model accommodates areas where outrage dominates, it does not fully account for the interaction between expert and public opinion on matters related to exposure.

Perhaps a better risk analysis framework is one that incorporates three independent elements, that is, hazard identification and characterization, exposure assessment and consumer/citizen

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