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ANALYZING QUALITY AND QUALITY ASSURANCE (INCLUDING LABELING) FOR GMOS

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The use of biotechnology can affect the actual and perceived quality of food products through its effect on an array of intrinsic quality attributes. Buyers may agree or differ on which of these effects creates high or low quality products. Labeling is an extrinsic cue that informs buyers, although imperfectly, about intrinsic quality characteristics.

Keywords: GMOs; quality assurance; labeling.

How Are Quality Perceptions Formed?

The use of biotechnology can affect the actual and perceived quality of food products in many ways. Caswell, Noelke, and Mojduszka argue that the quality attributes of food products can be analyzed effectively along three dimensions:

- *Intrinsic/extrinsic*: Is quality and quality perception influenced by attributes that are intrinsic to the product (e.g., nutritional content) or by quality indicators and cues that are extrinsic to the product (e.g., brand name)?

- *Information environment*: Is information on product quality of a search nature (the buyer can judge quality by evaluating the product prior to purchase, e.g., color), experience nature (the buyer must use the product in order to evaluate the quality, e.g., taste), or credence nature (the buyer cannot judge product quality even after purchase and use, e.g., pesticide residues)?

- *Vertically/horizontally differentiated*: Is quality vertically (buyers all share the same quality ranking) or horizontally (buyers have different quality rankings) differentiated?

Consider an example to make these dimensions concrete. Say the use of biotechnology produces a tomato that requires less pesticide use in production, has a distinctive shape, higher levels of vitamins A and C, poorer fresh eating qualities, and improved cooking qualities. The tomato is sold under a brand name. This product has intrinsic search attributes (its shape), intrinsic experience attributes (its use characteristics), and intrinsic credence attributes (its environmental impact and vitamin content). It also has an extrinsic quality cue (the brand name). The tomato's shape and brand name can convey

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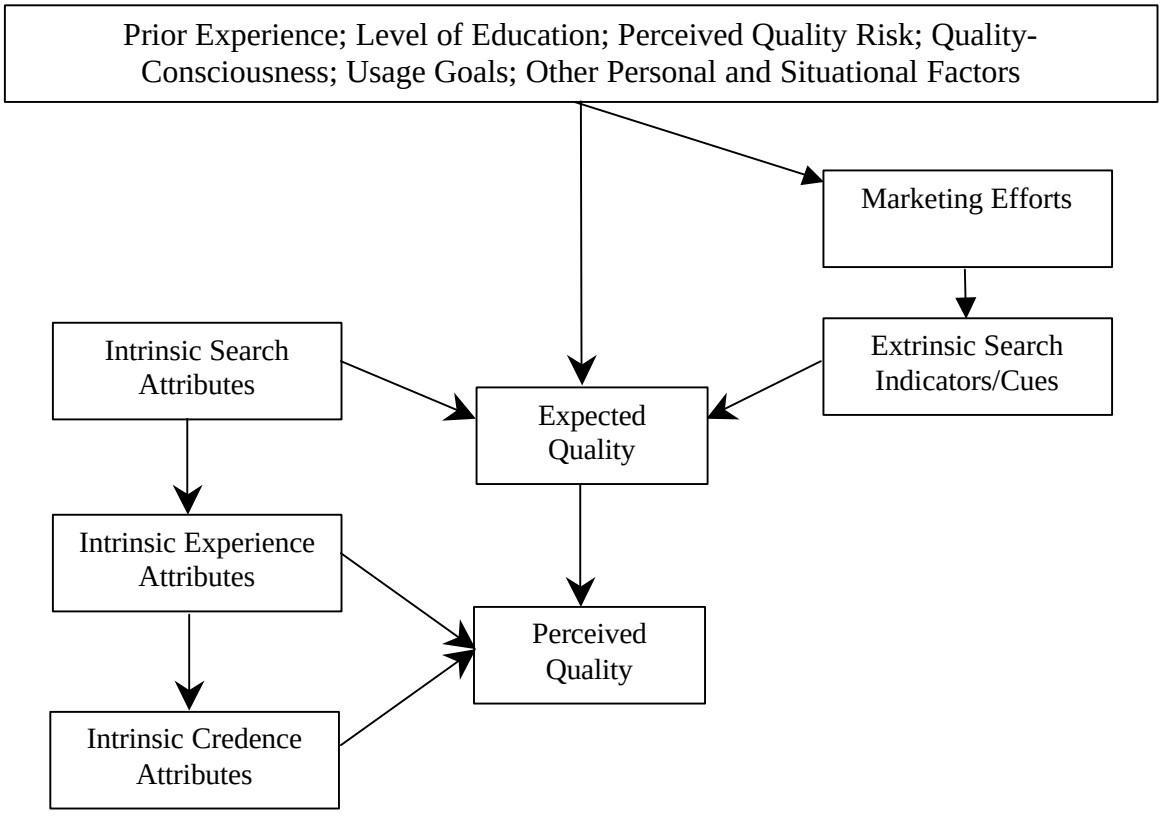
information to buyers on its genetically modified organism (GMO) status and credence attributes if buyers are sufficiently informed about the links between these attributes. This tomato is likely to be horizontally differentiated because some buyers will prefer its mix of attributes, while others will prefer tomatoes with other quality profiles.

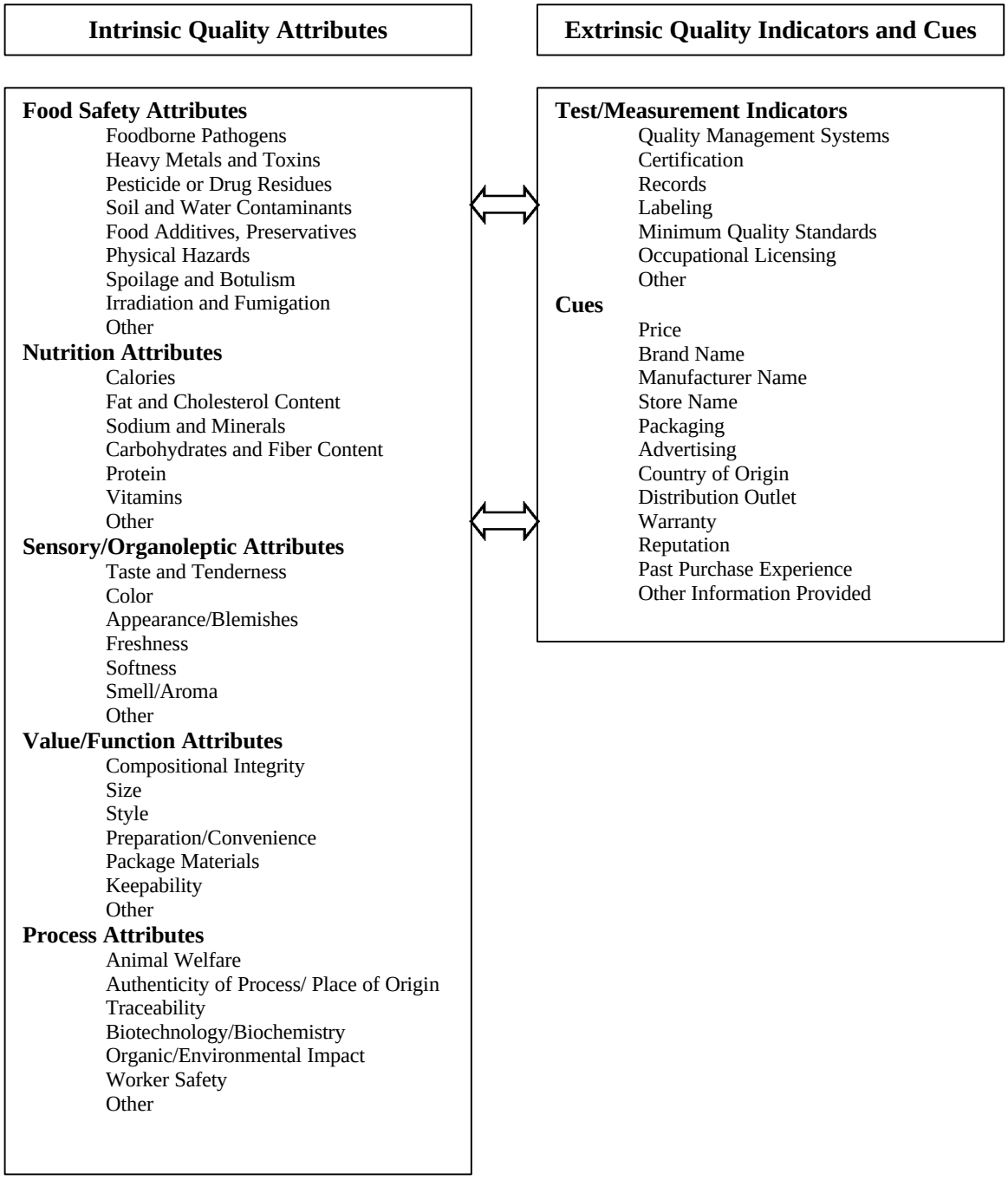
The main links between these dimensions of quality and how quality perceptions are formed are shown in figure 1. Sellers take their buyers' characteristics into consideration in designing marketing efforts and the indicators and cues they choose to use to signal quality. These indicators and cues are extrinsic to the product itself and are designed to be search in nature; the buyer can use this information prior to purchase to form expectations about the quality of a product. (For a list of these indicators and cues see the right column of figure 2). The buyer's quality expectation is also influenced by the intrinsic search attributes of the product. Perceived quality is then determined by expected quality, the buyer's use experience with the product, and the buyer's beliefs about the intrinsic credence attributes of the product. (For a list of intrinsic product attributes for food products see the left column of figure 2).

Figure 1: A Unified Quality Framework.



Note. From "Unifying Two Frameworks for Analyzing Quality and Quality Assurance for Food Products," by J.A Caswell, C.M. Noelke, and E.M. Mojduszka, *in press*, in Global Food Trade and Consumer Demand for Quality, B. Krissoff, M. Bohman, and J.A. Caswell (Eds.).

Figure 2: Intrinsic Attributes and Extrinsic Indicators and Cues.



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What Important Quality Characteristics Are Related To The Presence Or Absence Of GMOs In Food Products?

Studies of the acceptance of food products produced with the use of biotechnology tend to divide buyers into two groups: those that accept or are indifferent to the presence of GMOs and those who reject it. These studies have also generally noted that acceptance and rejection rates vary by type of biotechnology application. This captures, or begins to capture, the multidimensionality of the impact of use of GMOs on product quality. Some buyers care first and foremost about the use of biotechnology and accept or reject products on the basis of this intrinsic process attribute. Other buyers care about the presence of GMOs but also care about other quality attributes such as environmental impact, nutritional quality, and convenience of use. They will make tradeoffs, particularly if safety is assured, between GMO status and other desirable attributes associated with that status. Yet other buyers have no concerns about GMO status itself and will buy based on the other attributes when compared to those in conventional products. Use of biotechnology can impact a wide variety of intrinsic attributes and, thus, its impact on quality perception for a particular product is a composite of these effects.

The key point is that for buyers GMO status is horizontally, not vertically, differentiated. In other words, buyers differ in their quality rankings regarding foods produced with the use of biotechnology. In making purchasing decisions, some will want to know about the GMO status of the products they buy and some will not care. Those who want to know will want to know for different reasons, for example, to avoid GMOs or to be sure of getting particular attributes associated with GMO use. In some cases, the use of biotechnology in production will be evident in the intrinsic search attributes of the product (e.g., color, size). Other impacts of GMOs might be evident in the experience (use) characteristics of products. Finally, as has occurred with many so-called first-generation products, the use of biotechnology may be a credence attribute not easily evaluated even after purchase and use.

Whether a product's GMO status is a search, experience, or credence attribute is not set in stone. Normally, an attribute that is credence may be turned into a search attribute (one that can be evaluated prior to purchase) with testing, certification, and labeling. The question is not whether this is feasible but whether the benefits of this additional quality assurance and information outweigh its costs. Testing, certification, and labeling can also improve quality assurance and the information available to buyers for search and experience attributes. The balance of benefits to costs for such quality assurance and communication is in turn affected by technology (e.g., testing techniques) and the design of regulatory programs that mandate certification and labeling or control its voluntary use. Whether GMO status is a search, experience, or credence attribute may also be affected by the buyer's position in the supply chain. For example, processors may find it worthwhile, necessary, and profitable to test for GMO status, while it would not be economically feasible for consumers to do so.

Using Certification And Labeling To Communicate GMO Status To Buyers

As the list shown on the right side of figure 2 indicates, there is a wide range of extrinsic quality indicators and cues that may be used to influence the quality perceptions of buyers. These indicators and cues are searchable by definition; they are information that can be provided to the buyer prior to purchase. While they can influence quality perception for all intrinsic attributes, they are particularly important for credence attributes where the buyer has difficulty evaluating the product's quality. The transformation of intrinsic credence attributes into extrinsic search indicators or cues can facilitate quality evaluation and communication by both buyers and sellers.

The indicators and cues used by different buyers along the supply chain are likely to differ. Companies may rely on the certification of specific quality management systems among their suppliers to assure quality. Within the supply chain, having quality is often defined as consistently meeting or exceeding defined sets of standards for extrinsic indicators and cues. For example, a firm uses a set of extrinsic indicators, possible combined with its own tests of intrinsic experience and credence attributes, to judge whether a supplier is likely to deliver the contracted level of quality. Consumers are much less likely to find the effort worthwhile to specify closely the quality attributes of the food products they buy. Thus they will rely on less formal information in evaluating quality, with the result that more attributes are credence at the consumer level than within the supply chain. Consumers will tend to rely on simple indicators such as brand name, retailer reputation, and labeling in their evaluations.(Caswell, Noelke, & Mojduszka, *in press*)

In the case of GMOs, labeling is a consumer-level extrinsic cue that cuts across all other levels of the supply chain. Consumer level labeling requires segregation, testing, and certification throughout the supply chain to assure either the absence or presence of GMOs. The degree of that effort and whose responsibility it becomes depends on market incentives and the design of government regulatory programs (see Caswell, 2000).

Although approaches differ in details, mandatory labeling programs for GMOs in the European Union, Australia/New Zealand, Japan, and other countries essentially take an intrinsic attribute (use of biotechnology in the production process) and provide an extrinsic cue for it. This cue may require sellers to tell buyers when GMOs are present, absent, or both. Thus, the label is based on this one product attribute. In practice, depending on additional information the buyer has, the label may also convey information about other quality attributes that are related to GMO use. For example, a corn chip that is labeled as containing GMOs may tell the informed consumer that the corn was likely to have been produced with the use of fewer pesticides, making him or her more likely to buy. The same label may tell a different, informed consumer that the corn was not organically grown, making him or her less likely to buy. At the same time, the product's other attributes, indicators, or cues are providing an array of information on quality attributes of the product that may or may not be related to its GMO status. Thus, the GMO label is a one-dimensional cue for a production process that has a multidimensional impact on product quality.

Mandatory GMO labels are helpful to buyers who wish to avoid or find products produced with the use of biotechnology. For these buyers, GMO presence or absence is horizontally differentiated: some equate each with low quality and some with high quality. Mandatory labels help these consumers find the product that they consider "high quality." The drawback with mandatory labels is that everyone, even those who do not care, bears the cost of testing, certification, and labeling (for more on the costs of segregation see Stull in this issue). Mandatory programs probably make sense in countries where a large proportion of the population cares about GMO status (in other words, it is differentiated) and wants to select products based on it. These countries will tend to view mandatory GMO labeling as serving consumers' basic right to know important information about the products they buy.

Voluntary labeling, often with oversight by government regulators to assure truthfulness, allows part of the market to be differentiated regarding GMO status, while the rest remains undifferentiated. This is likely to make sense if the part of the market that cares about GMO status is small. Interestingly, the voluntary labeling policy of the United States is based on a different argument. The United States Food and Drug Administration (US FDA) argues that, under its statutes, when safety is assured and no significant change (e.g., in allergenicity or nutrient content) occurs in product quality, GMO and non-GMO products cannot be differentiated and mandatory labeling would be misleading. Thus, the policy is based on a technical rather than a demand based definition of differentiation.

Both mandatory and voluntary labeling programs for GMOs have limitations as methods of communicating about product quality, in that the label is one-dimensional (presence or absence of GMOs). For consumers, the full informational content of a GMO label will depend on all the additional information, indicators, and cues they have regarding the quality attributes of products produced with or without biotechnology.

In coordinating policy, or at least agreeing to disagree, countries, companies, and consumer groups can make use of the approach discussed here to frame market and trade issues related to the use of biotechnology in food production. Some of the issues to clarify are as follows,

- When and for whom is the presence of GMOs a vertically or horizontally differentiated attribute of food products? Which intrinsic quality attributes of food products are affected by use of biotechnology and how?

- What is the range of extrinsic indicators and cues that are being used to communicate to buyers about GMO status?

- How universal or standardized is or can be the use of extrinsic indicators and cues (e.g., the GMO label) to give information about underlying quality attributes (e.g., use of biotechnology)? Can governments develop "harmonized" approaches to labeling or is this unrealistic given differences in consumer demand and market structure across countries?

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For More Information

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