Lecture 6
Health Imlications of GM foods and Consumer Concerns

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Consumers and GM foods

The Amsterdam Treaty, the new legal framework for European integration, has explicitly introduced ***the right to information for the consumers***. European consumers have consistently demanded that GMO-food be labelled - not solely for reasons of safety, but in order to make an **informed choice**

Quality Dimensions* in Consumer acceptance

QD*: Product-specific characteristics which consumers believe indicate usefulness of product in fulfilling purchase motives

Classification of QD(Buyer expectations):

1. Health related (food safety)
2. "Hedonic": sensory pleasure-taste, aroma,texture
3. Convenience related
4. Process related: social, ethical and /or environmental concerns: "organic","GM, animal welfare etc.

Food Safety

- ***Safety*** is the most important atribute of foods. Other very important considerations such as quality, value for money, taste etc. come second. When the consumer chooses a product from the supermarket shelves,his first and over-riding presumption is that it should be safe.
- **To assure food safety, consumers expect**

  ***confidence** in producer and

  ***predictibility** of product

Types of QD Information available

- 1. Search: available at purchase
  i.e. Package uniformity and integrity
- 2. Experience: after consumption:i.e. taste
- 3. Credence: trust judgement of others through credible communication

Marketing food products based on credence is inherently problemmatic and require “credibility-enhancing devices” like “persuasive communication”.

Determinants of Persuasive Communication

- 1. Credibility of Source: advertisement by producer is always of lower credence than that of an independent third party verification of information.
- 2. Receivers' motivation and ability to process information(i.e. omega fatty acids health claims).

"Economics of Information Therory" : Once you believe information is credible , it becomes more useful and in higher demand.

Credible Communication on GM foods

- GM foods bear characteristics which consumers cannot search or experience themselves but have to rely on “credence dimension”

Credible communication has to include :

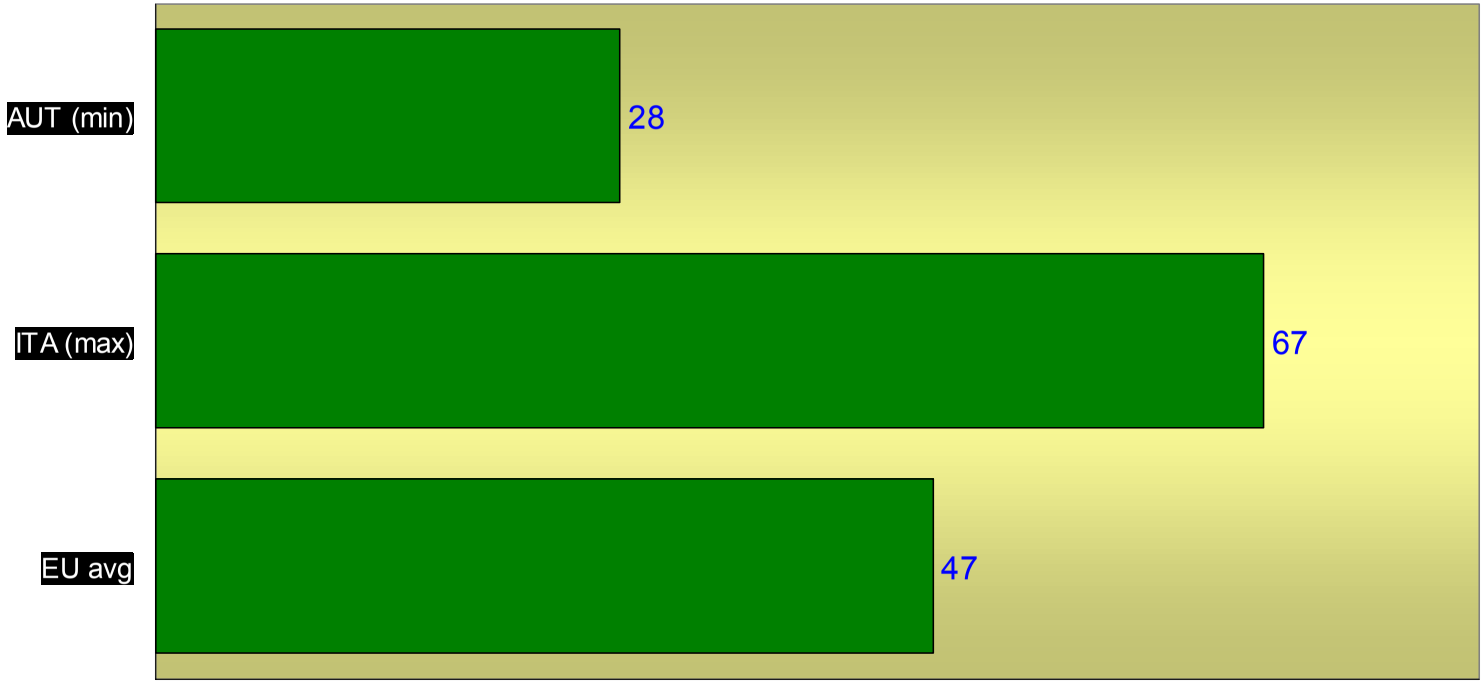
- 1.Whether product is or is not GM.
- 2. Whether GM technology is “bad” or “not bad.”

Consumers' GM Perceptions and Concerns(1)

Percentages in favour

<u>Social acceptance</u> of biotechnology* (* Used for medical, pharmaceutical, agricultural, animal husbandry and food purposes)

in theEU 1998 survey:
Source: Pogna, 2000



Example Consumer Studies: 1. Yoghurt study

- **Aim**: To determine consumer perceptions of yoghurt produced with GM culture
- **Improved Quality Traits**: low-fat, better taste and better texture
- N=50 consumers /country ,in 1997

  from Germany, Denmark, Italy and UK

Conclusion: A host of negative associations with GM ("unfamiliar", "morally wrong", "unnecessary", "unwholesome and artificial", "harms nature", "cannot trust") overshadowed purchase motives, and inhibited perceptions of benefits.

2. Cheese Study

Four cheese samples with GM and one conventional product were compared for consumer perceptions. (1999)

Total number of consumers= 285

(Denmark, Norway, Sweden, Finland)

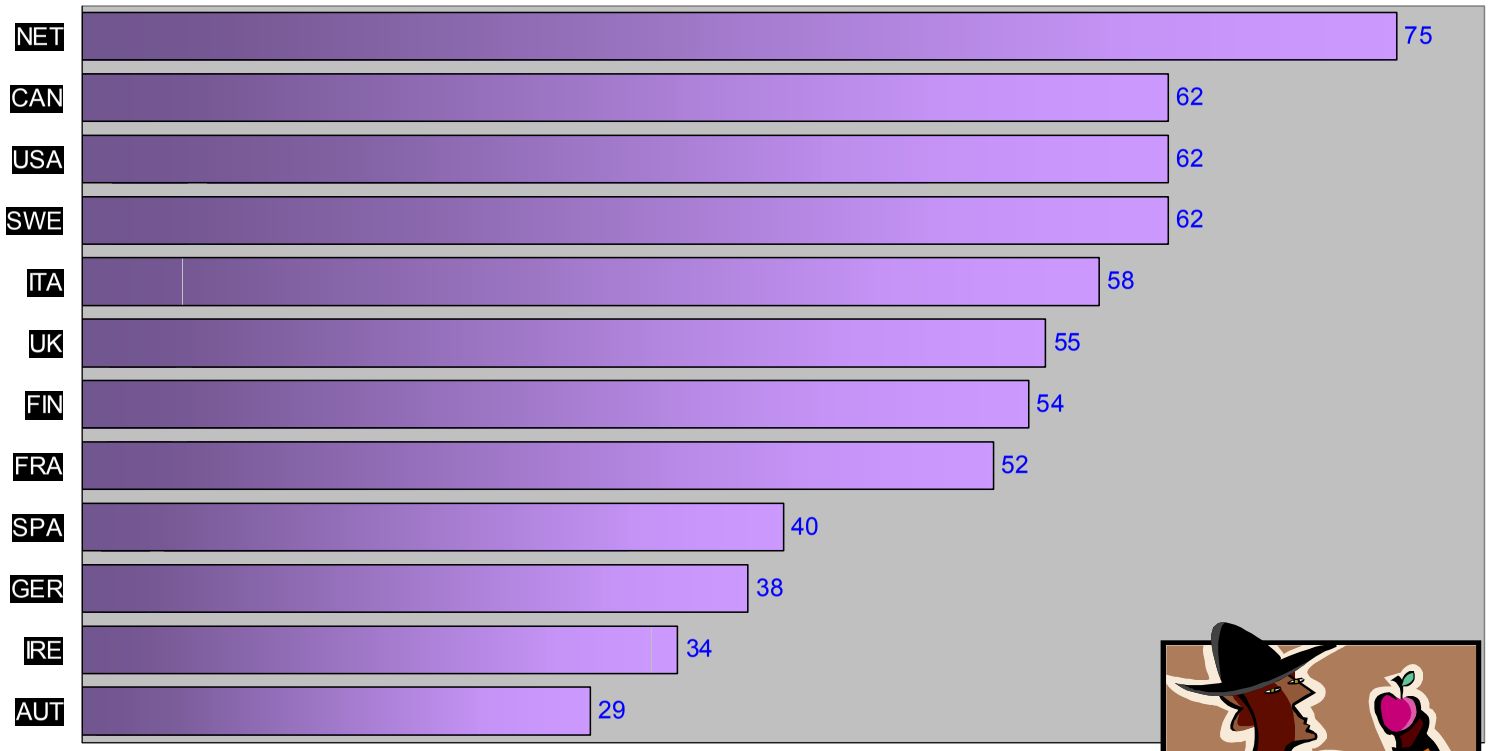
Conclusion: Consumers overwhelmingly preferred conventional product even though benefits of GM products were clearly acknowledged("good taste").

Lack of trust ("unnatural", "less healthy", "uncertainty", "may harm immune system") in GM technology over-shadowed the perceived benefits.

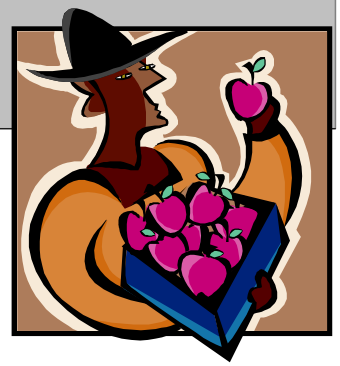
Consumers' GM Perceptions and Concerns(2)

Measuring Their Knowledge

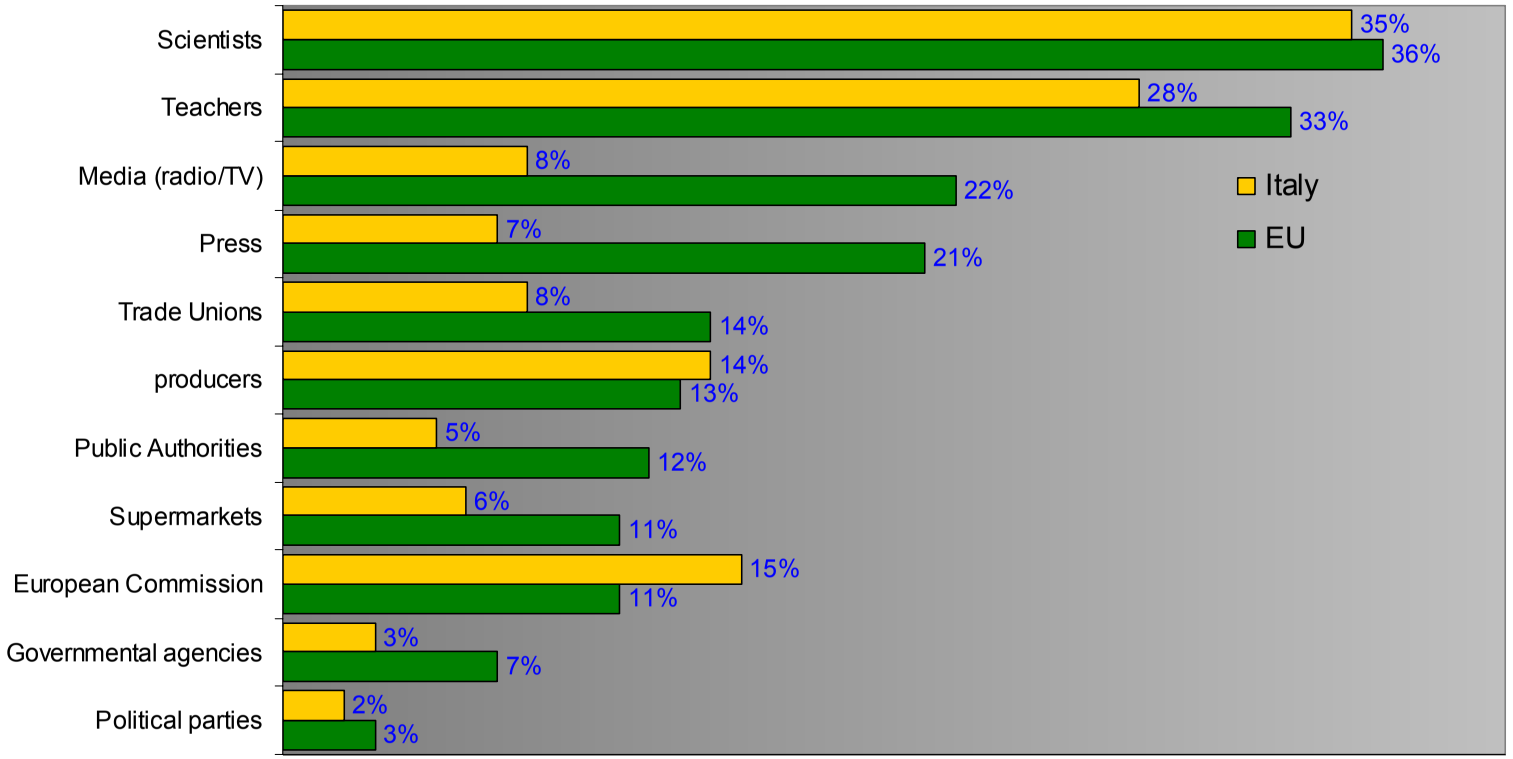
Percentage of correct answers to the question: "Does eating transgenic fruit determine a change in your own gene pool?" (NO!)



Source: Hoban T., Natbio 1997



Consumer's GM Perceptions and Concerns (3) Measuring Credibilities*



*Credibility: **Do they say the truth when talking about food quality and safety?**

Activists and lobby groups

Opposition from the public against genetic engineering being prominently displayed by graffiti on the side of an art gallery in New Zealand

The Scientist 15[11]:13, May. 28, 2001

Members of the *Earth Liberation Front* claimed responsibility for a fire at Michigan State University that destroyed a building being used for work related to agricultural biotechnology.

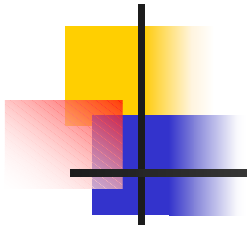
"Companies are not going to listen to morals," said *Earth Liberation Front spokesperson Craig Rosebraugh*. "If you cause them enough economic damage or economic sabotage to their industry, hopefully they will see that it is in their best interest to stop their unjust acts."

Famous Antibiotech Quotations from the Media:

1. Political activist Jeremy Rifkin has characterized biotechnology "as threatening a form of annihilation every bit as deadly as nuclear holocaust".

2. Greenpeace demands "complete elimination of biotech products from the food supply and the environment."
Greenpeace Executive Director Peter Melchett quoted: "Scientists can no more guarantee the safety of genetically engineered foods than they could predict the BSE crisis".

3. Prince Charles : "...genetic engineering takes mankind into realms that belong to God and God alone"..



•How are GM foods regulated and what is the government's role in this process?

•Governments around the world establish a regulatory process to monitor the effects of and approve new varieties of GM plants. Yet depending on the political, social and economic climate within a region or country, different governments are responding in different ways.

•In Japan, the Ministry of Health and Welfare made the testing of GM foods become mandatory as of April 2001 . Before, testing of GM foods was voluntary. Japanese supermarkets are offering both GM foods and unmodified foods; customers are beginning to show a stronger preference for unmodified fruits and vegetables.

•India's government has not yet anounced a national policy on GM foods because no GM crops are grown in India and no GM food products are commercially available in supermarkets yet . India is, however, very supportive of transgenic plant research. It is highly likely that India will decide that the benefits of GM foods outweigh the risks because Indian agriculture will need to adopt drastic new measures to counteract the country's endemic poverty and feed its exploding population.

•Some states in Brazil have banned GM crops entirely, and the Brazilian Institute for the Defense of Consumers, in collaboration with Greenpeace, has filed suit to prevent the importation of GM crops .

•Most Brazilian farmers, however, have resorted to smuggling GM soybean seeds into the country because they fear economic harm if they are unable to compete in the global marketplace with other grain-exporting countries.

•Europe is where anti-GM food protestors have been especially active. In the last few years Europe has experienced two major foods scares: bovine spongiform encephalopathy (mad cow disease) in Great Britain and dioxin-tainted foods originating from Belgium. These food scares have **undermined consumer confidence** about the European food supply, and citizens are disinclined to trust government information about GM foods.

•In response to the public outcry, Europe now requires mandatory food labeling of GM foods in stores, and the European Commission (EC) has established a 1% threshold for contamination of unmodified foods with GM food products .

In the United States, in the regulatory process , there are three different government agencies that have jurisdiction over GM foods:

- The EPA evaluates GM plants for environmental safety,
- The USDA evaluates whether the plant is safe to grow,
- The FDA evaluates whether the plant is safe to eat.

The EPA is responsible for regulating substances such as pesticides or toxins that may cause harm to the environment. GM crops such as B.t. pesticide-laced corn or herbicide-tolerant crops [but not foods modified for their nutritional value]fall under the purview of the EPA.

•The USDA is responsible for GM crops that do not fall under the umbrella of the EPA such as drought-tolerant or disease-tolerant crops, crops grown for animal feeds, or whole fruits, vegetables and grains for human consumption.

•The FDA historically has been concerned with pharmaceuticals, cosmetics and food products and additives, not whole foods. Under current guidelines, a genetically-modified ear of corn sold at a produce stand is not regulated by the FDA because it is a whole food; but a box of cornflakes is regulated because it is a food product. The FDA's stance is that GM foods are substantially equivalent to unmodified, "natural" foods, and therefore should not be subject to regulation.

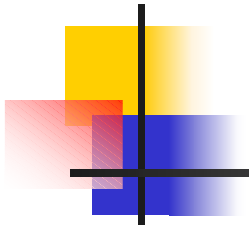
International Organizations Addressing Agricultural Biotechnology Issues

Discussions on biotechnology are taking place in Codex Alimentarius and the Biosafety Protocol. U.S. seeks to ensure guidelines set by these organizations are consistent with WTO disciplines.

Codex: Sets international food safety standards recognized under the WTO Sanitary and Phytosanitary (SPS) agreement. Active discussions related to biotech are taking place in several Codex committees. USDA manages overall U.S. participation in Codex. USDA and FDA lead U.S. delegations to Codex committees.

Biosafety Protocol: Environmental agreement under the U.N. Convention on Biological Diversity, covering the transshipment and use of living modified organisms. Protocol takes effect upon ratification by 50 countries. The United States has not ratified the Convention nor signed the Protocol. State Department represented U.S. interests at Biosafety Protocol negotiations.

WTO: Provides institutional framework for multilateral trade. Trade disciplines established under the SPS and Technical Barriers to Trade (TBT) agreements and the General Agreement on Tariffs and Trade (GATT) are related to biotech trade issues. USTR represents U.S. interests at WTO.



•How are GM foods labeled?

•Labeling of GM foods and food products is an important issue. On the whole, agribusiness industries believe that labeling should be voluntary and influenced by the demands of the free market.

•Consumer interest groups, on the other hand, are demanding mandatory labeling. People have the right to know what they are eating, argue the interest groups, and historically the food industry has proven itself to be unreliable at self-compliance with existing safety regulations.

•There are many questions that must be answered if labeling of GM foods becomes mandatory.

• First, are consumers willing to absorb **the cost** of such an initiative? If the food production industry is required to label GM foods, factories will need to construct **two separate processing streams** and monitor the production lines accordingly. Farmers must be able to keep **GM crops and non-GM crops** from mixing during planting, harvesting and shipping. Of course the industry will pass along these **additional costs** to consumers in the form of **higher prices.**

•Secondly, what are the **acceptable limits of GM contamination** in non-GM products? The EC has determined that 1% is an acceptable limit of cross-contamination, yet many consumer interest groups argue that only 0% is acceptable.

•Some companies such as Gerber baby foods and Frito-Lay have pledged to avoid use of GM foods in any of their products. But who is going to monitor these companies for compliance and what is the penalty if they fail? Once again, the FDA does not have the resources to carry out testing to ensure compliance.

•Thirdly, what is the **level of detectability** of GM food cross-contamination? Scientists agree that current technology is unable to detect minute quantities of contamination, so ensuring 0% contamination using existing methodologies is not guaranteed. A 1% threshold may already be below current levels of detectability.

•Finally, who is to be responsible for educating the public about GM food labels and how costly will that education be? Food labels must be designed to clearly convey accurate information about the product in simple language that everyone can understand. This may be the greatest challenge faced be a new food labeling policy: how to educate and inform the public without damaging the public trust and causing alarm or fear of GM food products.

UK Considers DNA 'Bar-Coding' to Increase GMO Traceability

In 2000, an international trade agreement for labeling GM foods was established. More than 130 countries, including the US, the world's largest producer of GM foods, signed the agreement. The policy states that exporters must be required to label all GM foods and that importing countries have the right to judge for themselves the potential risks and reject GM foods, if they so choose. This new agreement may spur the U.S. government to resolve the domestic food labeling dilemma more rapidly.

The European Commission adopted lately THE WHITE PAPER ON FOOD SAFETY, which is an ambitious action plan to transform today's EU food policy. The actions planned are based on a comprehensive, integrated approach throughout the food chain - in other words from **"farm to fork"** designed to make EU-legislation more coherent, understandable and flexible. There are more than 80 separate actions proposed which include also proposals on GMOs .

The White Paper provides that scientific assessment and advice must be based on independence, excellence and transparency. Public confidence can only be maintained in a system where scientific risk assessments are carried out by eminent scientists and independently of industrial and political interests. Scientific advice must be open to rigorous public scrutiny.

The Commission has proposed the establishment of an independent European Food Authority with particular responsibilities for risk assessment and risk communication to consumers to provide advice and guidance.

Unlike the FDA in USA, it will not have regulatory powers. These are entrusted to the Commission, the European Parliament and the Council of Ministers.

A clear distinction is made between, on the one hand, "risk-assessment" which has to be based on scientific excellence and independence and, on the other hand, risk-management which is the responsibility of decision-makers, who are politically accountable to the citizens

STRUCTURE OF RISK ANALYSIS

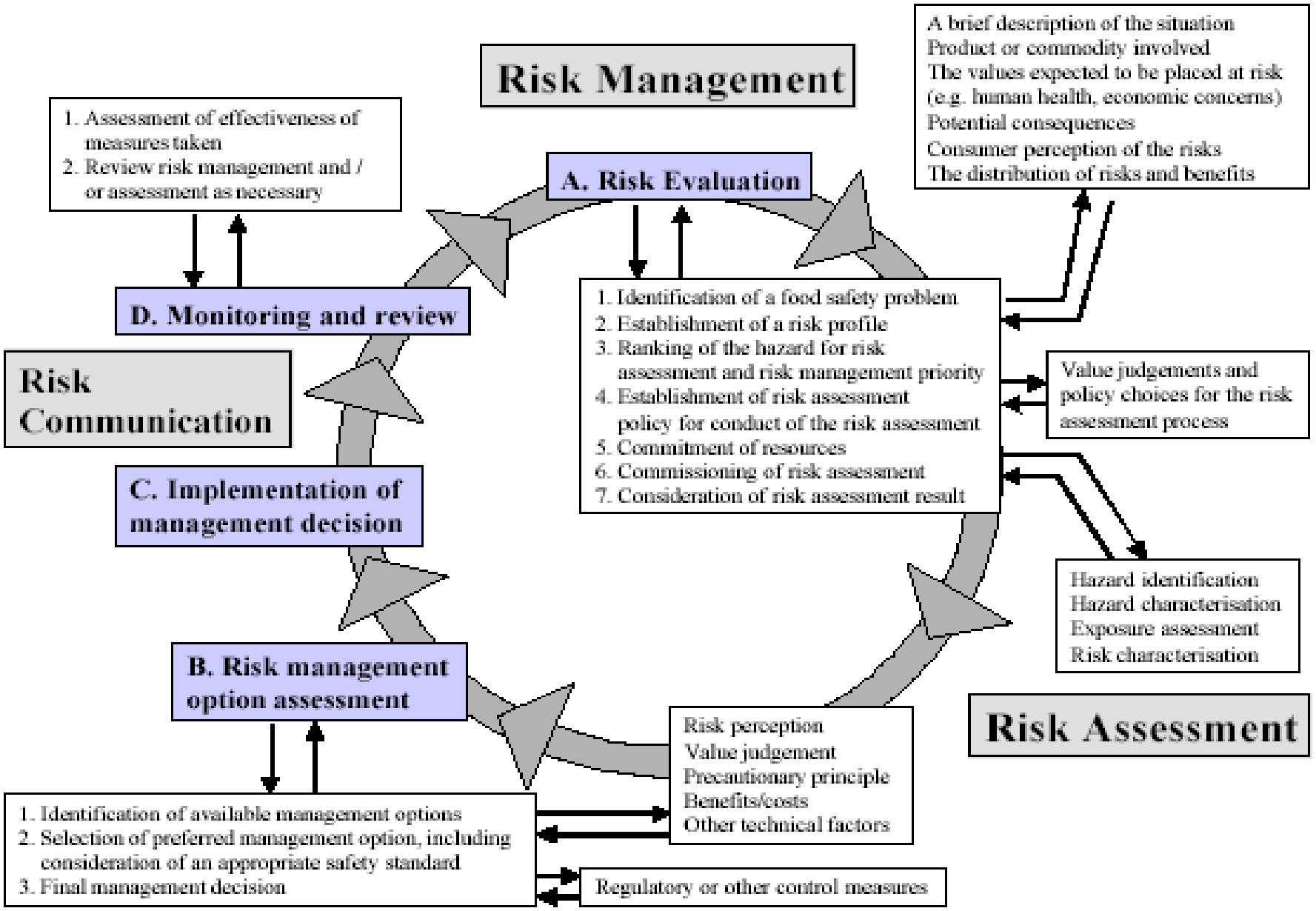
Risk Assessment

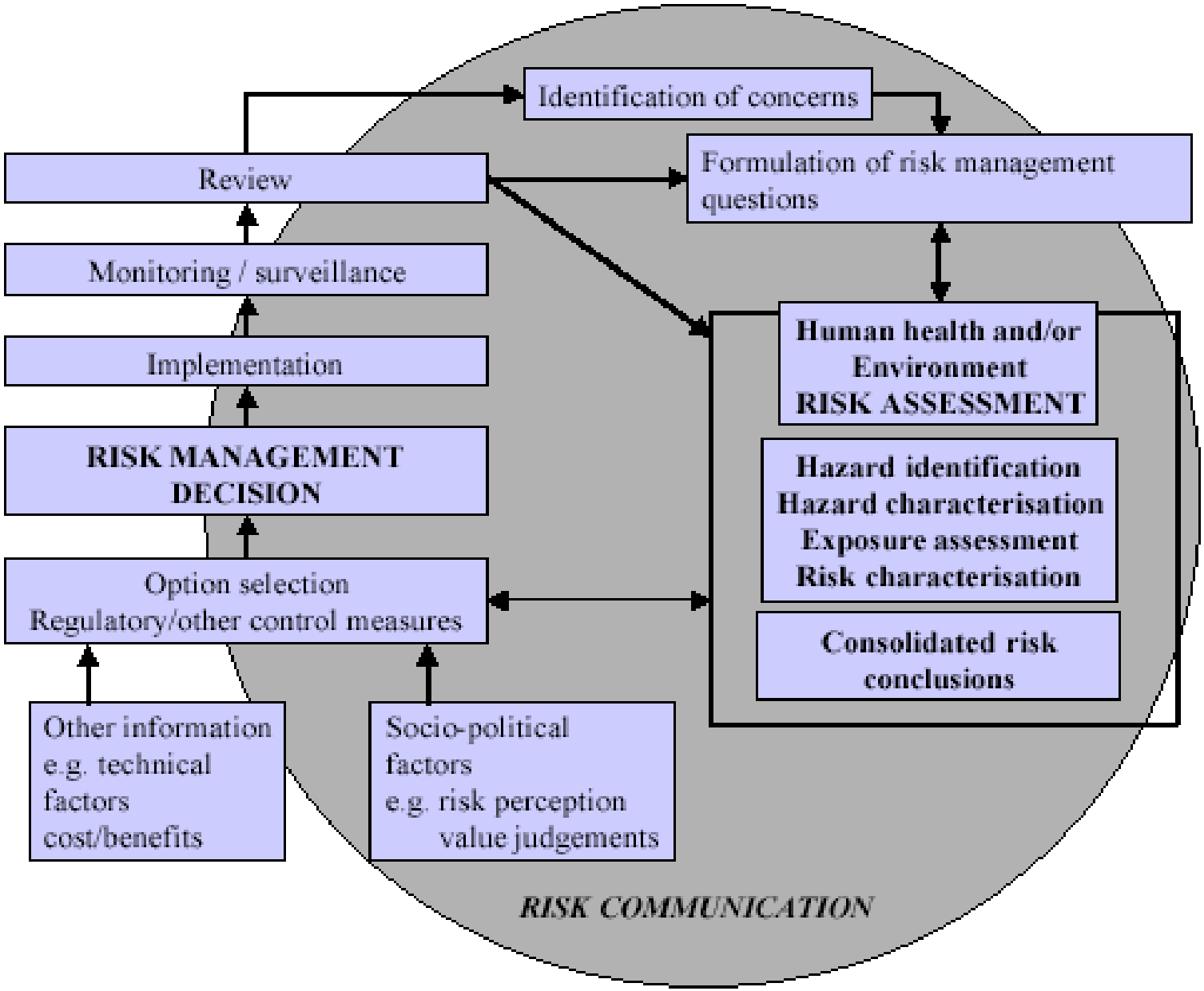
- Hazard Identification
- Hazard Characterization
- Exposure Assessment
- Risk Characterization

Risk Management

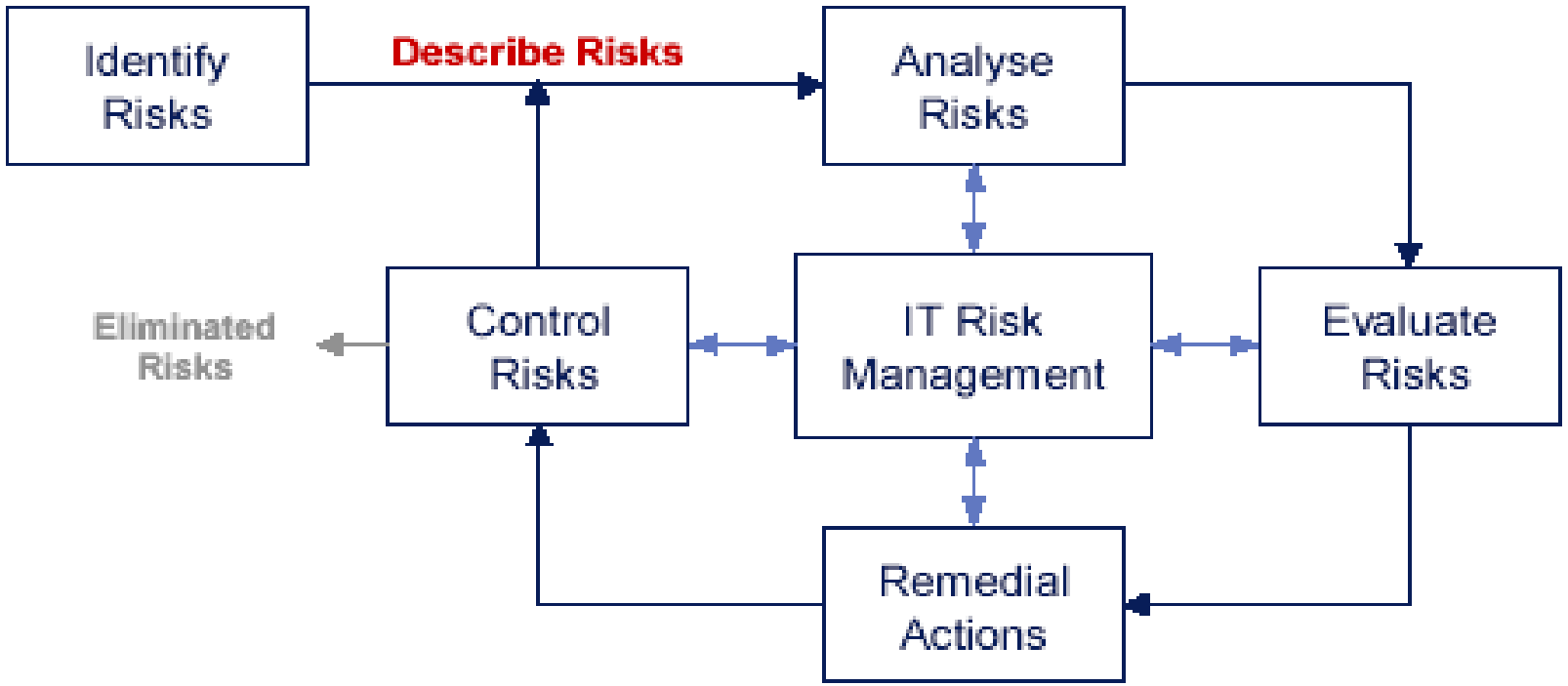
- Risk Evaluation
- Option Assessment
- Option Implementation
- Monitoring & Review

Risk Communication


Risk Management
A. Risk Evaluation
1. Identification of a food safety problem
2. Establishment of a risk profile
3. Ranking of the hazard for risk assessment and risk management priority
4. Establishment of risk assessment policy for conduct of the risk assessment
5. Commitment of resources
6. Commissioning of risk assessment
7. Consideration of risk assessment result
A brief description of the situation
Product or commodity involved
The values expected to be placed at risk (e.g. human health, economic concerns)
Potential consequences
Consumer perception of the risks
The distribution of risks and benefits
Value judgements and policy choices for the risk assessment process
Hazard identification
Hazard characterisation
Exposure assessment
Risk characterisation
Risk Assessment
Risk perception
Value judgement
Precautionary principle
Benefits/costs
Other technical factors
B. Risk management option assessment
1. Identification of available management options
2. Selection of preferred management option, including consideration of an appropriate safety standard
3. Final management decision
Regulatory or other control measures
C. Implementation of management decision
D. Monitoring and review
1. Assessment of effectiveness of measures taken
2. Review risk management and / or assessment as necessary
Risk Communication


Identification of concerns
Review
Formulation of risk management questions
Monitoring / surveillance
Implementation
Human health and/or Environment RISK ASSESSMENT
RISK MANAGEMENT DECISION
Hazard identification
Hazard characterisation
Exposure assessment
Risk characterisation
Option selection
Regulatory/other control measures
Consolidated risk conclusions
Other information
e.g. technical factors
cost/benefits
Socio-political factors
e.g. risk perception
value judgements
RISK COMMUNICATION

Risk Management Cycle



Risk Management Structure

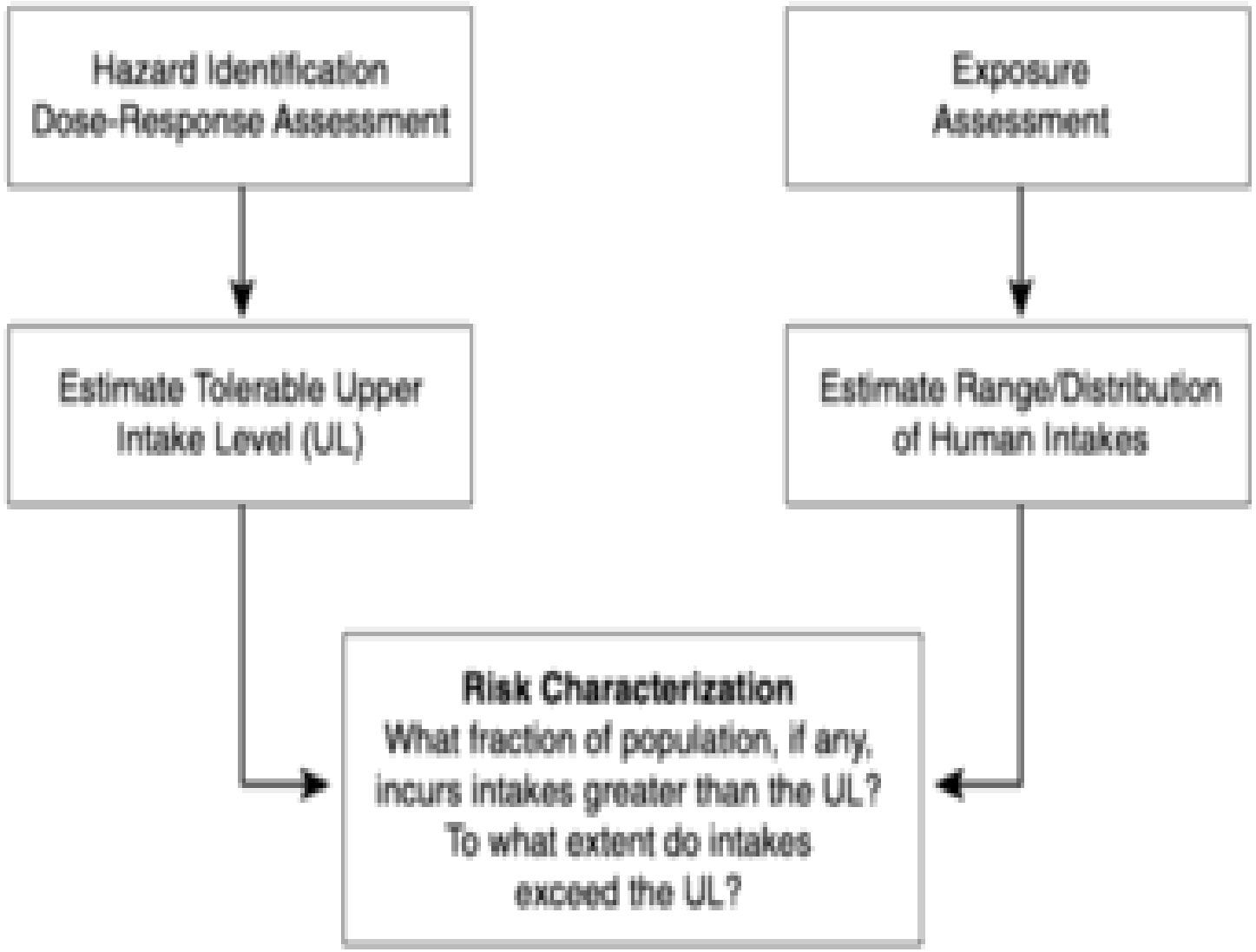
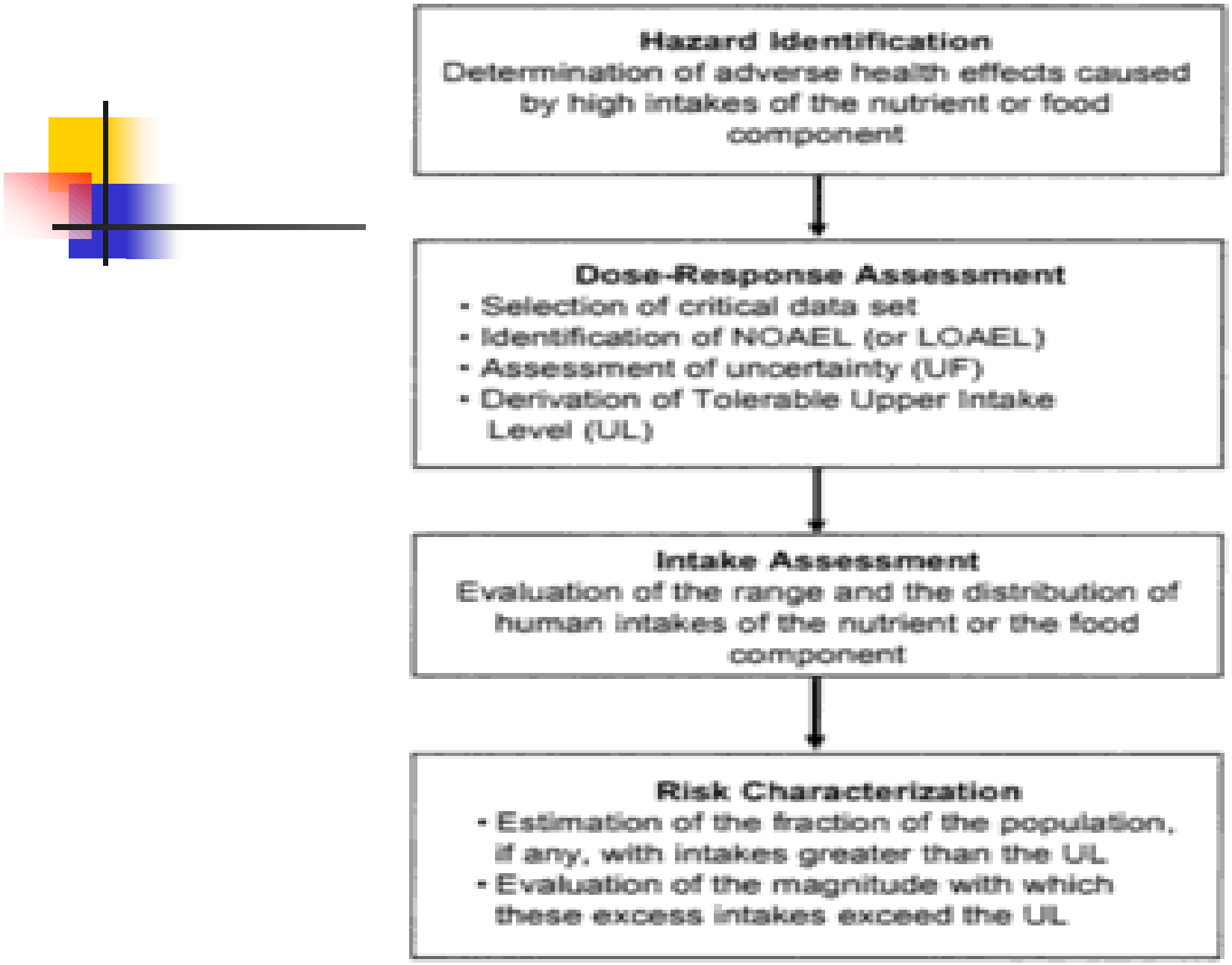


FIGURE 3-1 Risk assessment model for nutrient toxicity.


Hazard Identification
Determination of adverse health effects caused by high intakes of the nutrient or food component
Dose-Response Assessment
• Selection of critical data set
• Identification of NOAEL (or LOAEL)
• Assessment of uncertainty (UF)
• Derivation of Tolerable Upper Intake Level (UL)
Intake Assessment
Evaluation of the range and the distribution of human intakes of the nutrient or the food component
Risk Characterization
• Estimation of the fraction of the population, if any, with intakes greater than the UL
• Evaluation of the magnitude with which these excess intakes exceed the UL

QUANTITATIVE RISK ASSESSMENT

Probability → / Impact ↓	3 very likely	2 probable	1 improbable
4 unacceptable	6 high	5 high	4 medium
3 undesirable	5 high	4 medium	3 medium
2 acceptable with review	4 medium	3 medium	2 low
1 acceptable without review	3 medium	2 low	1 low

Proposed changes to EU Directive 90/220/EEC

- **Setting clear time limits during consideration of marketing release applications with the aim of giving a decision concerning an application within one year.**

- **Clarification of the risk assessment and harmonisation across member states to include assessment of direct, indirect, immediate and delayed risk or impact.**

- **Monitoring and time limitations for marketing consents, such that monitoring will occur post-release for commercial purposes. In addition marketing consents will have a finite life of ten years after which they must be reviewed.**

- **Improving the transparency of applications for consent to release for marketing, allowing the public to see the content of such applications.**

- **Appointment of a committee to deal specifically with the question of ethical issues arising from the application of biotechnology.**

CONCLUDING REMARKS:

- **Genetically-modified foods might have the potential to solve many of the world's hunger and malnutrition problems, and to help protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides.**

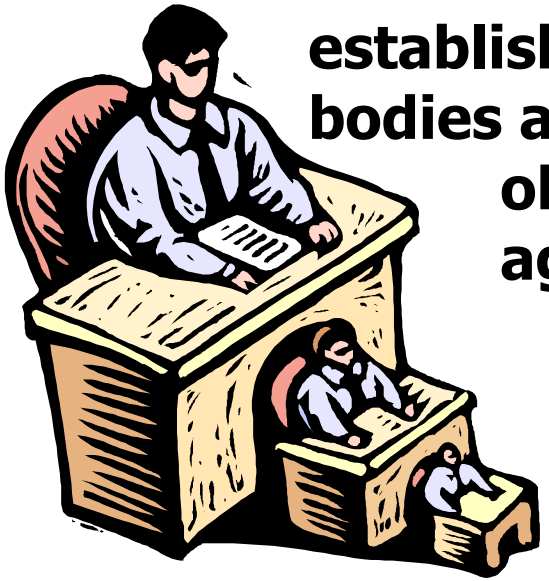
- **Yet there are many challenges ahead for governments, especially in the areas of safety testing, regulation, international policy and food labeling.**

- **Many people feel that genetic engineering is the inevitable wave of the future and that we cannot afford to ignore a technology that promises such potential benefits. However, we must proceed with caution to avoid causing unintended harm to human health and the environment as a result of sheer enthusiasm for this powerful technology.**

The ideal regulatory system should be an open, transparent and inclusive one where the factual risks are continually communicated to consumers and efficiently managed by responsible authorities.

The system should not necessarily be one promising the public absolute "zero" risk, but should have "public health protection" as its paramount objective, and be able to react quickly in cases of trouble.

National regulations should also be consistent with the consensus international guidelines and standards established by relevant international standard setting bodies and should accommodate the country's obligations under international trade agreements.



Risk and uncertainty will always remain as two major determinants of GM technologies and products, but not any more or any less significant than those of many other aspects of modern life , since neither risk nor uncertainty in other food processing unit operations, or in innovations in other technological fields, should be expected to ever reach absolute zero.