THE NEW FRONTIERS OF FOOD SAFETY

In modern societies, controlling health risks is a fundamental requirement, especially for such a sensitive field as food. Substantial progress has been made over the last fifty years. However, the horizon seems to recede as we improve our standards. While it is difficult to accept that zero risk is impossible to achieve, new and unknown dangers appear every day. What are the new challenges of our time and how can we meet them?

Let's look back at the recent developments, which are spectacular. Over the last few decades, food safety has undergone a permanent revolution, marked both by crises, technological breakthroughs, and profound social, economic and political evolutions.

The spotlight is on health risks

These changes concern primarily space and time. First of all, space: the scale at which one must analyze health hazards has drastically changed. In a few decades, risk assessment has jumped from family and local scales to national, continental and global. The famous mad cow crisis, as other crises due to Listeria in the 1990s, are good examples, as they involved national and even cross-border flows. Second, time: the time-lapse in which these risks must be managed has shortened. We have gone from a long-term management, emphasizing hygiene education and the gradual reduction of hazards, to management of the moment and of emergency. We eventually made a new step forward with the adoption of general prevention and the application of the precautionary principle. Thus, in the early 1990s a new field of application of mathematics emerged, the modeling and forecasting of risks associated with microbial growth in foods: predictive microbiology.

Apart from changes of scale and temporality, the processes taken into account during the analysis are also increasingly complex. This affects primarily the control of hazards. The emphasis on risk is undoubtedly a hallmark of the food industry since its origins. This industry was born and developed at the same time as microbiology and the promotion of basic hygiene. The focus on biological and microbiological hazards is at the heart of manufacturing procedures and controls. But the analytical framework has changed: while twenty or thirty years ago, we still favored a segmented approach,

isolating each stage of the product life, today we tend increasingly to consider processes in their entirety, from the field to table.

In this context, it is absolutely necessary to conduct epidemiological investigations and trace the source of danger in the product life-cycle and anticipate causality links from upstream to downstream. As for forensic science, the emergence of methods based on molecular science and gene amplification in the early 1990s has significantly improved as have the control capacity and expertise all along the chain. Molecular typing helps identify the agents responsible for the contamination and determine the source of infection and transmission routes. Gene amplification is an in vitro technique that allows tracing infinitesimal amounts of DNA: a single known DNA fragment of a known gene is amplified by generating great numbers of copies which can then be identified by a specific probe capable of recognizing the gene.

Beyond this change of method in the assessment and management of risk, the multiplication of the issues – and therefore of the players involved – also adds to this increasing complexity. It is no longer simply a matter of feeding the population or building industries: public health policies are concerned, as well as food safety, food quality and the impact of diets. With the creation of the WTO (1995), the analysis of health risks was converted in the main concern regarding cross-border trade. At the same time, concerns over public health intertwine with the desire to protect certain markets. They also mix with issues of environmental protection, which places new constraints on the different sectors and leads to the emergence of new expertise and regulation authorities.

Developed countries have begun to build new relations between public authorities, scientific expertise and companies. The legal framework is being gradually incorporated into an international regulatory harmonization. The respective responsibilities of public and private actors in risk management have evolved: in the European Union, the “Hygiene Package” (five Community regulations adopted between 2002 and 2005) leaves the effort to the companies: the burden of proof lies on the manufacturer who must demonstrate the safety of the substances used.

Last but not least, the cultural dimension of food should not be overlooked. Food safety often implies contradictory constraints. Food risk perception and our relation to our food involve both an expectation of progress and modernity and a desire to preserve traditional references. In this respect, the media and their interactions with various

stakeholders (companies, administrations, agencies expertise, consumer associations) play a crucial role.

In this given context, our western societies – who are world leaders in this field – have developed management systems and reliable scientific expertise to anticipate most of the identified hazards and manage risks effectively. Overall, this is a success: despite an increase in the range of hazards, risk levels remained at very low values. But both the nature and perception of risk are constantly changing, and we are now facing several questions.

First, regarding future threats: which specific importance should we give to chemical hazards? Knowing that there is no such thing as “zero risk”, can we nevertheless continue reducing existing risks? Following what approach? This leads us to examine the key role of expertise and to what extent we can rely on it. Finally, how does the issue of food safety integrate within the global challenges of tomorrow? Let’s try to get a clearer picture.

Chemical hazards, the new frontier?

Recent history is marked by the emergence of chemical and toxicological hazards. These risks are associated with farming (hormones, antibiotic residues), cropping (pesticides), processing methods (e.g. acrylamide, a carcinogenic polymer which builds up in frying some products) or more generally, with the environmental contamination linked with production or processing.

Recurrent debates on the safety of pesticides in foods are examples. DDT is banned in Norway and Sweden since 1970, in the United States since 1972 and in Britain since 1984. But despite the measures taken to limit their presence in the environment, the persistence of toxic remains is a topical issue: the recent crises in the French West Indies with kepone, a pesticide sometimes found in soils used for food crops, is an example.

Many substances may be found in natural industrial and commercial (packaging) environments of agricultural raw materials and processed foods. This presence may be related to a lack of foresight, an accidental or even fraudulent situation (pollution, mixture of banned products...). Recent crises associated with dioxins are a good illustration. These substances were introduced in 2009 in animal feed (poultry, pigs) from fats adulterated with engine oil. They were also found in the 1990s and 2000s, in

animal products (e.g. milk) as a result of contamination of pastures in the vicinity of defective incinerators or that did not have the adequate facilities to limit these emissions.

In the coming years, issues related to chemical hazards should increasingly engage all public and private actors, for several reasons.

First of all, detection capabilities are improving, particularly with the increasing availability of high-resolution measurement methods. It should be mentioned that research in food toxicology, somewhat neglected over the past twenty years, is receiving again significant investments. We can already foresee major improvements in the identification and characterization of hazards, for example with new approaches to toxicity testing.

This research dynamic meets the emergence of new risks: the food sector is indeed very innovative, with many breakthrough innovations. The emergence of new substances, such as nanoparticles, whose safety is not yet known, requires great caution.

Finally, the new awareness of public opinion concerning chemical hazards leads to a strengthening of regulations all around the world. As well known, this is the case in Europe, with the REACH directive of 2006 which aims at phasing out from the EU the most dangerous chemicals substances, regardless of their uses.

Up to what extent can we reduce the risks?

Whether chemical or microbiological risks, conventional and emerging, there is no such thing as zero risk. This truth was rediscovered during the crises of the 1990s (BSE, Listeria...) and it is a source of concern and frustration. The population is subject to fears that neither the experts (often incomprehensible), politicians (accused of partiality), nor the companies (suspected of being motivated by purely economic considerations), are able to handle.

For the consumer, the risk is even less acceptable that, despite all traceability requirements, he is incapable of knowing anything about the origin of raw materials and more generally, about what “hides” behind the product: the danger, process and players involved. The consumer’s concern is, in a way, the price to pay for complexity, the sophistication of industrial processes and the scientific knowledge involved in the production and testing of products.

In fact, the number of potential hazards has increased significantly at the same time as development, even though the risks are generally better controlled, thanks to the entire evaluation and management mechanisms. Levels of risk considered acceptable have now reached very low values. Let's take the example of listeriosis, a very dangerous infection caused by Listeria monocytogenes. Between 1987 and 1997, the incidence of listeriosis in France fell from 16.7 cases per million inhabitants (all patient categories combined) to 5.4 cases per million inhabitants and eventually reached around 4 cases per million in 2006. In Europe, the incidence is between 2 and 10 cases per million. Can we get even lower results without negative impacts on our food model and on the costs for the industry and ultimately, on consumers?

For the hazards that are already assessed within our control procedures, it would be difficult, in general, to seek a further reduction in risk insofar as the provisions already in force are respected. The question is not whether we should avoid at all costs an accident which, according to all likelihood, is inevitable. The aim should rather be to ensure that in case of failure or emergence of danger, our evaluation and management systems are reactive enough to limit the spread. Certainly, there are still many exceptional situations, such as the recent so-called "cucumber" crisis of E.coli 0104/H7, in Germany. However, in many countries, investigation, warning, assessment and recall procedures have advanced significantly.

Thus, we can restate the problem, considering that the issue has less to do with the possibility of a progress to be made, than with the social acceptance that there will never be zero risks and that this value depends heavily on our choices. So we will need to carry out collective tradeoffs. In this regard, public debate is in its infancy. A major challenge of the coming years will be to provide citizens and consumers with information to better understand the economic, social, environmental consequences of the further reduction of some risks to an even lower value (the so-called cost/profit balance). For now, this concept hasn't emerged in the debates. Yet, it will be at the heart of the times to come: the economic tension in the territories of production, stress on our global resources essential, a new framework for innovation and development.

A crisis of expertise?

With the evolution of food markets and changes in the scale of production and distribution, the economic and political dimensions associated with health issues have taken a strategic importance. This accentuation of the economic and social challenges has placed expertise at the heart of decision making. Scientific recommendations have gradually taken an unprecedented collective importance: both in terms of health, due to

the high diffusion of the products concerned, or in terms of the economy, due to the growing importance of evaluation in all national and international regulations. Expertise has become a focus of attention... and of suspicion. Trust in experts has been undermined by the major crises of the 1990s. Trust can neither be decreed nor established. It is not enough to summon skills, academic credentials for citizens to blindly trust the emitted recommendations. This confidence is a fragile feeling that touches fundamental aspects of our existence, such as security and “living together”. It has to be earned!

To achieve this, three main principles stand out from the ongoing evolutions. First of all, collective intelligence and plurality of views are stronger than any individual opinion. Second, expertise should not be influenced by issues other than those which objectively use the most relevant knowledge and scientific analysis. Third, citizens must have a full access to information throughout the whole the whole procedure, from the first question to the result of the analysis.

It is in the light of these principles that the agencies created in the 1990s as a result of major health crises have led their action. The case of the French Agency for Food Safety (AFSSA) is exemplary. Since its first months of existence in 1999, the agency has established an independent and transparent recruitment of experts; it has formalized the conduct of collective assessments and has established public statements of interests (for the experts as for its personnel) and has led a very active policy of information and transparency; it has played its role of surveillance and alert...

This new approach to sanitary examinations has helped strengthen the confidence of the population. However, the performance of these devices is never definitively acquired. There are several weak spots and worrying possibilities of drifts. In addition to conflicts of interest, other independence defects can disrupt the objectivity of scientific analysis: ideological, ethical, political biases. It is very difficult to control these elements. The best protection is to rely on the broad range of experts involved in collective evaluations. The GMO debate, like the one prevailing during the sanitary crises of the 90s, is a particularly illustrative example of how fragile a scientific argumentation can be if it does not take place in a perfectly neutral, legitimate framework, protected from all suspicions.

More broadly, it is very important that the examination process itself is subject to regular evaluations. These assessments should focus on the three principles mentioned above: plurality of points of view, independence and transparency.

The sanitary safety issue and global challenges

Demographic projections estimate that world population in 2050 will be over 9 billion people. This evolution of the population could lead to great stress on agricultural and food production. The agricultural resource is one of the four fundamental human resources along with quality water in sufficient quantity, energy available at affordable cost, biodiversity and the ecologic services associated with it.

This challenge does not only address our collective ability to preserve the availability of each resource. Their interrelation – which makes the whole system very unstable – and the arrival of a new factor, climate change, adds to an already difficult task.

These new sustainability issues already produce disturbances in the flow of goods and raw materials: beyond the effects of climatic variations on large crops, speculation on raw materials and the increasing demand for processed agricultural products from emerging countries... The significant commitment of the agricultural sector and of agro-industrial countries in a consumer society has led to a level of development that is now the reference imposed on all countries in the WTO context. For developing countries, the globalization of agricultural trade and agro-industrial products is a major social and economic issue.

A country like Brazil understood the importance of these issues by investing heavily in this sector and positioning itself among the world leaders. But for the vast majority of developing countries, globalization is associated with a strong pressure on prices and constraints that are difficult to predict from a sanitary point of view. These countries face several challenges at once: they need to ensure the food security for a fast growing population, structure the production and transformation chains, have the capabilities and technology to ensure the sanitary safety of products and processes to levels of requirement equivalent to those implemented in industrialized countries. In a few years, they need to reach a level of productivity, competitiveness and sanitary reliability equivalent to that achieved by industrialized countries in fifty years.

However, as pointed out by Marcel Mazoyer and Laurence Roudart, on the 3 billion farmers present on the planet, 1.3 billion are agricultural workers of which one third works with nothing more than their hands: no seed selection, no fertilizer, no draught animals. The number of tractors in the world is estimated at about thirty million. The least developed countries have a productivity that can be thousand times less than the most productive (and mechanized) countries. Only 10% of global agricultural production is in circulation on the international markets. These raw materials are

produced by the countries with the best productivity and set the rates charged to all, based on high yields and relatively low costs. One can easily understand the difficulty for African farmers to sell safe products at a competitive price on their local markets.

To ensure the safety of food and agriculture, the challenge would be to double the world average production by 2050. This production effort may imply increasing by 5 times production in some underdeveloped countries.

The model of mass access to food products as it has developed in the industrialized countries is not necessarily one that will suit all developing regions. But regardless of the model of development that will be needed, safety issues will be crucial. They are the other side of the food challenge.

One of the issues is obviously the regulation of commodity markets in order to avoid double penalty for developing countries. In addition, pressure on agricultural and food resources can be mitigated only if they adopt a sustainable policy of agricultural and agro-industrial development. This implies that agro-industrial countries provide their experience through a rapid transfer of expertise and innovation: the challenge is to combine the development of consumption with the control of sanitary safety.

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