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PERCEPTION OF NUTRITIONAL RISKS (malnutrition, overweight). A CASE STUDY IN VIETNAM. Implications for risk management.

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Abstract

Food-related risks became priorities of public health, at the time of food abundance where malnutrition by deficiencies became unacceptable and obesity and associated diseases strongly increased all over the world.

The public actions to fight against nutritional problems rely on information diffusion and education of the public. These interventions remain dominated by psycho-sociological general models (as the theory of reasoned action of Fischbein and Ajzen) or models applied to health behaviors as the Knowledge, Attitude, Beliefs, Practices (KABP) model promoted by the WHO (1989). Based on the theory of subjective expected utility, these models make the hypothesis that an improvement of individuals' knowledge will modify their attitudes towards risks what will change their risk management behaviors.

However, investigations in health-nutrition confirmed that an improvement of knowledge level on prevention and control tools was not a sufficient condition to improve individual behaviors. In spite of their knowledge, some individuals do not conform to the recommendations and continue to behave in a way which expose them or their relatives to risks.

In this article, we favour two paths of explanation of the shift between recommendations and food behaviours (1) the understanding of the differences in risk perception between the "experts" (in charge of evaluating and communicating on the risks) and the "laymen" (2) the analysis of cognitive biases between risk perception and individual behaviour.

The preventive actions stigmatize people's inaccurate behaviors as "irrational" and thus aim to reduce this distortion by leading the citizen to perceive the "real" objective risk defined by experts. This article proposes an alternative approach relying on the idea that "false beliefs" form part of the collective representations and that individuals develop responses integrating the risk. People's risk perception is more qualitative and complex than experts' one and individual behavior depends on a set of psychological and social factors.

Instead of reducing behavioral process as a linear and mechanist relation, we consider it as a dynamic system in which all the elements (knowledge, beliefs, attitudes and behaviors) are in constant interaction, characterizing various risk management strategies and rationalities.

This research is based on works in economic and social psychology to study mothers' perception of two nutritional risks : risk of malnutrition by deficiencies and risk of overweight/obesity in Hanoi (Vietnam). The psychometric paradigm represents in particular a useful tool to analyze people's subjective risk perception, considering it as multidimensional. Our study aims at putting forward the psychological mechanisms (cognitive biases, barriers) influencing risk perception.

On the whole, 240 mothers of children from 6 to 10 years old were questioned on the basis of a quantitative and qualitative questionnaire. Mothers' knowledge, risk perception, food practices and nutritional status of mothers and children were characterized. First results are proposed.

This article shows the contribution of risk sociology (psychometric paradigm) and social psychology (cognitive biases) to widen the conception of individual rationality. This research underlines others subjacent logics explaining individual exposure to risks. The disposals set up by the individuals to face risks are compromises between objectives, know-how and concurrent risks (between health and pleasure, health and self-image, etc).

This work aims at lighting the policies of nutritional risk management on the individual and collective representations as profane knowledge guiding behaviors. The integration of the risk into individuals' responses must bring to regard the individual as a social subject and not simply as a target of the interventions.

Introduction of the problematic

During last decades, the economics development, the rise of consumers' purchasing power, technological progress as well as the distribution development modified the world food landscape and the consumption models. Whereas the majority of nutritional deficiencies disappeared, the challenges in nutrition and health fields have changed in nature (*Le Bihan, Delpeuch & Maire, 2002*); today, we notice a high prevalence of chronically non-communicable diseases, such as some cancers, cardiovascular diseases, type 2-diabetes, allergies and osteoporosis. High social and economic costs resulted; in 2001, the chronic diseases accounted for 59% of the 56,5 millions deaths in the world and 46% of the world load of morbidity (*WHO, FAO, 2003*). In 30 years, the cardiovascular diseases became the most common cause of mortality in Europe (first cause of mortality in France with 32% of the deaths, *MFS, 2000*).

Food-related risks became public health priorities, in a context of food abundance where malnutrition by deficiencies became unacceptable and obesity and associated diseases strongly increased all over the world.

In order to fight against nutritional problems and to prevent food-related diseases, the authorities implement measures, either acting on food supply (promotion of nutritionally adapted and/or enriched products and diets, production increase, nutritional recommendations for diets in collective restaurants, etc), or on food demand (improvement of food safety, education and information, nutritional awareness campaigns, to influence people's food preferences and to increase physical activity). Thanks to information and education campaigns, the authorities and health professionals hope to lead consumers to become aware of the close links between food and health and to feel responsible for their consumption (*MFS, 2000*). However, whereas information on health is more and more disseminated, we observe an important shift between the nutritional recommendations and the food behaviours, which would not be due to a lack of consumers' knowledge as regards to nutrition-health (American paradox, AIDS).

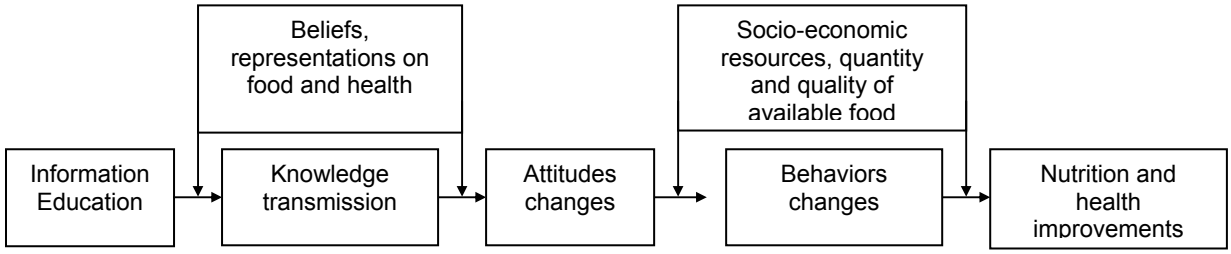
In this article, we favour two paths of explanation of the gap between recommendations and food behaviours (1) the comprehension of the differences in risk perception between the "experts" (in charge of evaluating and communicating on the risks) and the "laymen" (2) the analysis of cognitive biases between risk perception and individual behaviour.

Individual choices are subjected to a whole of uses and implicit rules. Food-related risks are built on the basis of perceptions and subjective representations, integrating beliefs, symbols and socio-cultural values (*Fischler, 1990; Poulain, 2002; Corbeau & Poulain, 2002*). Individuals seem to over-estimate certain risks, like the technological risks (ESB, GMO, food additives) and to underestimate others, like life style related risks (harmfulness of tobacco, food risks, AIDS, road accidents) (*Frewer, 1994*). Thus, perception and evaluation of food-related health hazards by the authorities and the scientists appear far away from the concerns and requirements of the public. This would justify the existing gap between the importance that the population, the media, the policies and the scientists attribute respectively at certain risks.

Even if it is recognized that risks are understood and interpreted differently by the groups of the society, health hazards were largely defined according to a scientific prospect, by experts, until recently (*WHO, 2002*). The risk is analysed according to the dominant standard model called "positivist", which proceeds of a linear analysis in three phases : the scientific evaluation (determination of the acceptable level of risk), risk management

(establishing the need and the type of measures which will make it possible to reduce the risk) and risk communication. As communicators consider that risk perception by the public is "subjective" and "irrational" compared to the "objective" risk evaluation by experts, the aim of risk communication is to reduce this distortion by leading the citizen to perceive the "real" risk (*Hansen, Holm, Frewer, Robinson & Sandoe, 2003*).

The actions of public communication, the educational interventions to target populations are dominated by psycho-sociological models which link the attitude[1] and the behaviour. These models were first developed to take into account general behaviors, like models of the theory of reasoned action (*Fishbein & Ajzen[2], 1975; Ajzen & Fishbein, 1980*) or of the theory of planned behaviour (*Ajzen[3], 1985);* others models[4] were applied to specific health behaviours like the Health Belief Model (*Rosenstock, 1974; Becker, 1974*), the Protection Motivation Theory (*Rogers, 1983*), or the "KABP" model (Knowledge, Attitude, Beliefs, Practices) promoted by WHO (*1989*). These implicit models of conventional nutritional education assume that bringing information upstream will make it possible to improve knowledge and individual choice abilities, in order to bring a change of attitude, which will result in improved food practices and therefore in a better nutritional status.



« KABP » Model (WHO, 1989)

Even if these models resulting from the subjective expected utility theory showed their validity to predict risk-taking behaviours[5] (*Cho, Keller & Cooper, 1999*) such as smoking (*Bauman, Fisher, Bryan & Chenoweth, 1984*), drinking alcohol (*Bauman & Bryan, 1983*), the sexual behaviours (*Bauman & Udry, 1981*), they do not make it possible to account for the complexity of the behaviours.

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1 "positive or negative psychological predisposition towards an object" (*Eagly & Chaiken, 1993*)

2 From a psychosocial point of view, the theory of reasoned action, based on the subjective expected utility model developed by Edwards (*1954*) proposes an explanation of the behaviours on which the individuals have a control; they modelize the behaviour as a function of the intention determined by an attitudinal factor (attitude towards behaviour, A_b) and a normative factor (subjective norm, SN) :

$$I = w_1 A_b + w_2 SN = w_1 \Sigma b_i e_i + w_2 \Sigma nb_j mc_j$$

w_1 and w_2 = weights
A_b = = function of people beliefs (b_i) and the evaluation of consequences (e_i)
SN = function of people beliefs on social norms (nb_j) and the motivation to conform to it (mc_j)

3 To take into account behaviours on which individuals have an incomplete and unconscious control, the theory of planned behaviour incorporates the PBC "perceived behavioural control" or self-efficacy (individual perception on its capacity to initiate or support a specific precaution behaviour; *Bandura, 1986*) :

$$I = PBC\ (w_1 A_b + w_2 SN) = \Sigma c_i p_i \ [w_1 \Sigma b_j e_j + w_2 \Sigma nb_k mc_k]$$

c = beliefs of control
p = perceived power of a particular control factor

4 These models take into account the perceived vulnerability to the future negative consequences of the behaviour. They postulate that the more the individuals will feel vulnerable to the disease, the more they will be likely to implement precaution or protection health behaviours (Precaution Adoption Process of *Weinstein, 1988*; Health Belief Model of *Rosenstock, 1974*, Protection Motivation Theory of *Rogers, 1983*).

5 behaviours which can have harmful consequences on health

Quantitative investigations like KABP, researches in health-nutrition as in many other domains confirmed that an improvement of the knowledge level on the preventive methods and control was not a sufficient condition to improve individual risk management behaviours. In spite of their risks knowledge, some people do not conform to the recommendations and continue to have practices which expose them to the risks. Various elements of explanation were advanced : economic reasons, time constraints or dysfunction of the communication system itself (*NIN, UNICEF, 2001; Adrien & Beghin, 1993*). The main argument of the prevention actions is to stigmatise these practices that are not in conformity with the established and diffused recommendations by qualifying them as "irrational", thus justifying an intervention in educational matter. The inaccurate knowledge considered as "false beliefs" is the central object of the information and communication actions, which seek to form risk representations based on experts' views, contributing to unify the risk representations and uncertainties.

Therefore, according to this scientific approach, the relation to the risk is reduced to a linear and mechanist process in which knowledge determines the attitudes, beliefs and behaviours. However, these components of risk management are part of a dynamic system in which all the elements are in constant interaction, characterizing various strategies of risk management and setting alternative strategies or risk deny (*Calvez, 2004*). The psychological and social determinants are recognized as important determinants of risks evaluation (*Kahneman & Tversky, 1972; Slovic, Fischhoff & Lichtenstein, 1982*) and practices (*Corbeau & Poulain, 2002*). One of the privileged explanations is the existence of a shift between the way in which the "experts" (in charge of the risk analysis and risk communication) and the consumers "laymen" represent and evaluate the risks (*Slovic, 1992; Fife-Schaw & Rowe, 1996; Marris, 1999; Peretti-Watel, 2001*), public having a more complex and qualitative risk perception. So, it seems important to clarify the mechanisms at the origin of the formation of the individual and collective risks perception and evaluation[6].

In the 1990's, particularly in Europe and North America, the obviousness of the limits of the scientific approaches of risk evaluation and management allowed to admit legitimacy to considerate differences in risk perception by the groups of society, putting them in an economic, social and cultural context (*WHO, 2002*). Thus, the quantitative procedures of risk analysis were supplemented by sociological and psychological approaches to widen the concept of "risk" and to try to integrate individual perceptions in its evaluation. Risk perception was gradually seen like an obstacle to rational decision-making. The study of the shifts between experts and citizens in their methods of risk evaluation became central for risk policies (*Chevassus-au-Louis, 2000*).

The majority of the studies devoted to the question of the differences in expert-layman perception results from social psychology and aim at explaining perceptual biases (heuristics, optimism biases, illusion of control). Psychometric research partly explain how "laymen" perceive the risk.

This article first describes how the risk is evaluated from a rational decision prospect. Then, we present a review in economics and social psychology which have moderated the assumption of maximization of the utility criterion and show that individuals are prone to cognitive biases during the phase of risk evaluation. The psychometric paradigm offers in particular an interesting analysis framework and a methodological tool to study profane risk perception.

[6] The evaluation represents the cognitive component of the attitude (*Lavidge & Steiner, 1961*).

Then, a study carried out in Vietnam (Hanoi) on the perception of nutritional risks by mothers who have children from 6 to 10 years, is presented. It mobilizes the assets of the psychometric paradigm of Slovic and researches in psychology to break up the individual risk perception and to highlight some cognitive biases. First results are proposed.

Finally, the article argues about the stakes and implications of studying individual nutritional risk perceptions for the managers and the communicators.

1. Risk definition from the scientific prospect

The risk is evaluated according to the microeconomic theory and in particular the theory of the subjective expected utility[7] "SEU" (*von Neuman & Morgenstern, 1944; Savage, 1954*), a decision theory in risky universe. The SEU proposes a representation of the agents behaviours within a context of risky situations and postulates that an agent, which follows a rational decision-making process, will assign a value of utility on each level of possible richness. In health field, one can compare these levels of richness with the various possible health status. The total utility, numerical representation of the total individual attitude for a given action, is the sum of the product of the desirability and the probability of each consequence : $\textbf{Utility} = \sum_{n} p_i \, u(\text{consequence } i)$

n : number of potential consequences for health
p_i : probability of the consequence i
u(consequence i) : desirability of the consequence i

The decisional problem structure consists in the identification of risks, possible alternatives and their consequences and also in the evaluation of the various consequences of each action (in terms of desirability and probability); that makes it possible to calculate and order the utility of each option according to combination rules, the option offering the greatest utility being regarded as "the best" option (*von Winterfeldt & Edwards, 1986*). In this neo-classic approach, the subject relies on a probabilistic rationality in risky situation and seeks the maximization of a utility function. The preferences reflect a bond between the expected utility and risks characteristics (*Payne, 1975; Coombs & Lehner, 1984).*

Accordingly, experts evaluate the risk by a measurement of utility expressing the importance of the risk (severity in term of deaths, damage) weighed by the probability (uncertainty) of the occurrence of the consequence (loss) : $\textbf{Risk} = \sum_{n} (\text{severity} * p_i)$

n : number of potential negative consequences for health

A consensus seems to exist on the origin of the risk which consists in the probability of an unfavourable event and the importance of its consequences (*Rayner & Cantor, 1987*). The perceived risk thus fits in a negative approach of the consequences of the behaviour through the concept of losses, even if several authors in marketing (*Yates & Stone, 1992; Dandouau, 2001*) consider the risk at the same time in terms of benefits (anticipated result higher than expectations) and losses (anticipated result lower than expectations). But these two aspects of the risk are subject nevertheless to a different evaluation (*Tversky & Kahneman, 1981*).

[7] The theory of the subjective expected utility takes into account the fact that the subjective values associated with the probabilities function in a different way from the mathematical probabilities.

Bauer (*1960*) defined the risk related to the purchase of products as "*the perception of an uncertainty relating to the negative consequences potentially associated to a choice alternative, to the possibility of undergoing losses at the purchase time or the consumption time of a good or service*".

As regards to food health, the term of risk implicitly refers to the losses and their seriousness, health and life being concerned. In the case of food, "*the health hazard is thus a combination of the perceived importance and probability of the potential negative consequences of food consumption on health*" (*Muraro-Cochart, 2003*).

The different authors consider that, jointly with a number of variables, perceived risk is an "explanatory variable of the total attitude towards a product or a class of products" (*Muraro-Cohart, 2003*). The risk-related unfavourable beliefs form the base of the attitude. Thus, risk perception is considered like an inherent component of the attitude formation.

Many authors in marketing criticized the multiplicative character of the model. *Bettman* (*1973*) confirms the existence of a positive relationship between the components "uncertainty" and "negative consequences" of the purchase but proposes an additive relation between the two components. The consumer would add the scores of uncertainty and consequences, to obtain a representation of the total risk :

$$\textbf{Perceived Risk} = \sum_{n} (\textbf{Severity} + p_i)$$

n : number of potential negative consequences for health
p_i : probability of the consequence i

In a study analysing sexual behaviours among young people (ACSJ), *Peretti-Watel* (*2000*) questioned the teenagers on the perceived gravity (G) and frequency (F) of various health hazards, and on the perceived fear for themselves (C), with the aim of testing the predictive validity of the multiplicative traditional model :

$$\text{Ln } (P(C=1))/(1-P(C=1)) = \alpha_0 + \alpha_G \times G + \alpha_F \times F + \alpha_{GF} \times (G \times F)$$

$\alpha_0, \alpha_G, \alpha_{GF}$: parameters to be estimated

The author shows that the combination rule of the risks is additive and rejects the assumption of independence between perceived risk gravity and frequency :

$$\text{Ln } (P(C=1))/(1-P(C=1)) = \alpha_0 + \alpha_G \times G + \alpha_F \times F$$

To explain the failure of the basic model in predicting perceived fear, the author assumes that people distinguish the risk for themselves (or their relatives) from the risk for the others, because they implement particular mechanisms of risk deny which enable them to affirm that themselves are not, or little, exposed at a given risk, even if this one is frequently concretised around them. Several studies underline the important distinction between personal and general risks which bring to different judgements (*Drottz-Sjöberg, 1993; Peretti-Watel, 2000*). This is matching with optimistic biases developed further.

This distinction and the methodology of the Peretti-Watel's study were included in the present empirical research undertaken in Vietnam (*cf 3rd part*).

2. Psychosocial dimensions of the risk : differences in risk perception between "experts" and "laymen"

2.1. Cognitive biases at the origin of shifts between risk perception and individual behaviour

Research on decision-making thus revealed the insufficiency of the models based on SEU which do not take into account psychological dimensions which play an important part in the decision process. This concept of perceived risk based on the subjective expected utility theory was first put into question by Allais (*Allais' paradox, 1953*) then by Kahneman and Tversky (*1979*).

Empirical work of the latter tried to explain the "paradoxes"[8] observed when people take their decision. They developed the "prospects" theory (*Kahneman & Tversky, 1979; Kahneman & Tversky, 1992*) which contributed to moderate the assumption according to which the consumer chooses between several alternatives by maximizing an expected utility. They proposed a decision criterion in risky situation in which the consequences are evaluated by an utility and the probabilities are deformed by a function.

They showed that the individuals are prone to biases in their judgements, called "cognitive biases" when they structure the information and evaluate the probabilities and the alternatives (*Kahneman, Slovic & Tversky, 1982*). They highlighted in particular :

- the tendency of the subjects to over-estimate small probabilities;
- the change of attitudes and behaviours towards risk according to the "framing" of the problem : subjects would be averse to the risk in situations of gains (e.g. when the problem is formulated in terms of rate of survival), and would seek the risk for situations of losses (death rate) (*Tversky & Kanheman, 1981*);
- the individuals judge the risk starting from a reference point *(statu quo*); *Kahneman & Tversky (1979)* postulate that people feel loss in a situation where "*an individual obtains a result lower than a reference point... coming from the experience, social reference, target value, the better possible expected result, a minimal regret compared to the other alternatives* ".

Other cognitive biases were identified :

- the evaluation of the losses and the probabilities are not independent; it seems that the subjective transformation of the probabilities is all the more optimistic as the consequences are more desirable (*Slovic, 1966*) and that on the contrary the risks associated with particularly negative consequences are balanced in a pessimistic way (*Viscusi, 1995*);
- a phenomenon of "anchorage" and conservatism when individuals revise the probabilities; the initial points of view are resistant against the change and new informations will be considered if they are consistent with the initial beliefs of people (*Slovic, Fischhoff & Lichtenstein, 1980*);
- an effect of certainty (*Ellsberg's paradox, 1961*): the subjects more strongly balance certain than uncertain events.

A central bias factor in perception is the feeling of control and risk management. The empirical studies show that the individuals over-estimate or underestimate certain risks. Thus, some people would be optimistic as for their potential to control the risks (*Lloyd, Paisley & Mela, 1995; Lappalainen & Al, 1997; Rozin & Al, 1999*). These optimistic biases, called in

[8] Under experimental conditions in laboratory, the subjects do not make their decisions according to the theory.

psychology "unrealistic optimism" and "comparative optimism", refer to the fact that individuals considered themselves less likely to experiment negative events and more likely to experiment positive events, compared to the others (*Weinstein, 1980; McComas, 1999*). Weinstein (*1989*) showed that the individuals considered themselves systematically less exposed to the risk than the others. Sandman, Weinstein & Miller (*1994*) highlighted that health hazards (tobacco, over-consumption of fat, lack of physical exercise, etc.) were typically characterized by under-reaction, i.e., by apathy, rather than by panic.

In the health domain, optimistic biases imply that individuals are less likely to adopt self-protection behaviours (*Dejoy, 1996; Weinstein, 1983, 1984).* The more the person thinks he/she knows the risk (knowledge biases), the more he/she thinks of being able to protect himself/herself (*Weinstein, 1998*).

One of the factors contributing to optimistic biases is the degree of perceived control. The illusion of control returns to the belief of the individuals to have control on a situation more than they really have (*Langer, 1975*); this feeling results in a less risk aversion (*Mc Kenna, 1993*) and an unrealistic optimism on the consequences of an event (*Weinstein, 1980*); Teuber (*1990*) showed that people who cook perceive less risk to be poisoned than those who do not. These optimistic biases exist whatever the sex, age and education level of the subjects (*Weinstein, 1987*).

In addition, the studies show that individuals judge a risk while referring and comparing themselves with standards or stereotypes; if they do not estimate they correspond to the stereotype, they underestimate the probability of being exposed to the risk, deploying then "ego-defensive" mechanisms of risk deny. Douglas & Wildavsky (1982) explain the installation of this “symbolic protection” from the cultural influence of the group; the risk would be perceived as specific to a given group, to which the individual considers to belong or not, estimating himself little or not exposed.

Another work on the risk evaluation mechanisms highlighted the tendency of people to be naturally risk-averse while seeking to avoid it ("risks avoiders") or on the contrary to be "risk takers" (*Heimer, 1988; Tuler, Machlis & Kasperson, 1992; Renn, 1992; Cherpitel, 1993; Le Breton, 1995*). The individuals who take risks (by challenging social conventions, for physical well-being, etc) would be predisposed to take it, which would explain dangerous behaviours for health (for them or the others); it is what the psychologists call "the generalized acceptance of risk" and the "social desinhibition". These characteristics are regarded as features of personality, stable tendencies of the personality which affect the behaviour.

These studies in psychology thus have highlighted mental strategies as a whole, called "heuristics", that the agents use to interpret the world and to simplify the processes of evaluation and choice, underlining the subjectivity of risk perception. The individuals would estimate the level of risk induced by a situation not from objective data ("real" risk) but from subjective impressions ("perceived" risk) (*Bauer, 1960*), which have psychological and social anchoring. Moreover individuals do not have the same tolerance to the risk. The risk is a social and cultural construct reflecting values, symbols, history and ideology (*Weinstein, 1989*).

These cognitive biases are particularly important in the evaluation of food risks, because of the relationships between the consumer and the food act, ie the way a foreign substance is incorporated (*Rozin, 1994; Fischler, 2001*); inherent concern and anxiety with the food act (as revealed these last years by food crisis) would come from the magic and classificatory thought. The magic thought makes reference to the beliefs and magico-symbolic

representations systems based on a non-rational logic (*Dadoun, 1994*). It relies on fundamental principles in particular the principle of incorporation, contagion and the law of similarity (*Fischler, 1990; Rozin, 1994*). The process of categorization aiming at organizing knowledge is important in the food area because it plays a major role in calming down the homnivore's anxiety (*Chiva, 1998; Fischler, 2001*). In a view to simplificate, the classifying thought tends to arrange food in opposite categories (bad/good, cold/hot for example) and so constitutes a source of biases in the risk evaluation. Thus, the food would be essentially risky and anxiogenous and the food health hazard is not limited to the physical aspects but has moral dimensions (identitar and psychological) (*Muraro-Cochart, 2003*).

Finally, research as experiments show that the experts and the public do not give the same significance to the risk, although, as Slovic observed, the experts are inclined with the same prejudice as general public; in particular when they are constrained to speculate beyond the limits of the data available, they trust in their intuition (*Kahneman, Slovic & Tversky, 1982; Slovic, 1987*). Even when the risk can be easily quantified, we often observe a radical divergence between its evaluation by the experts and its perception by the public (*Fischler, 1998; Marris, 1999).*

In-depth interviews with mothers in Bolivia (*Lefèvre & De Surmain, 2002*) showed that their perceptions of the well-being of the children were radically different from the technical answers (size and weight measurements) provided by the health system.

Individuals have their own way of apprehending uncertainty and have a more complex and qualitative risk perception, integrating subjective judgements of ethics and of psychosocial nature built-in in their risks representations (*Fischhoff, Slovic, Lichtenstein, Read & Combs, 1978; Slovic, Fischhoff & Lichtenstein, 1979; Slovic, 1992*). When they evaluate the risks, the laymen are more interested in the nature of the consequences than in their probability (*Marris, 1999*) and they attach particular importance to the circumstances surrounding the exposure to the risks, and the concerned people.

The multidimensional risk analysis which we present in the following part aims to explain this distinction between the points of view of experts and non-experts and to understand the determinants of risk acceptability.

2.2. The psychometric paradigm and multidimensional risk analysis

This research field on risks perceptions has been developed in the 1970's with a first work on the identification of risk dimensions (*Slovic, Fischhoff & Lichtenstein, 1980; 1982; 1985; Sparks & Shepherd, 1994; Fife-Shaw & Rowe, 1996*). More recent works were interested in the individual differences between risks perceptions (gender, ethnicity, nationality) (*Slovic, Flynn, Mertz, Mays & Poumadere, 1996; Rohrmann, 1995*) and in the social construction of risks (cultural theory of *Douglas & Wildavsky, 1982*; theory of the social amplification of the risk of *Kaperson, 1992*). The contribution of sociology and anthropology brings a different lighting by stressing sociocultural anchoring of risk evaluation and its acceptability and the existence of social biases (*Douglas & Wildavsky, 1982; Dake, 1991*).

The psychometric paradigm (*Slovic, Fischhoff & Lichtenstein, 1979*) was the most mobilized and validated for studying the determinants of public attitudes towards risks (*Slovic, 1992).* It has been developed following the work of *Starr (1969*) showing that the individuals seem to accept the risks as long as they are associated with benefits and if they are regarded as "volunteers". If the voluntary risks imply by definition a decision maker and return to the concerns of Bernouilli, the involuntary risks refer to "victims", which raises the question of the acceptance of risks that one makes run to others (*Sjöberg & Al, 2004*). Being

based on the psychology and decision sciences, the psychometric paradigm makes the principal assumption that risk is subjective in itself and that its perception is integrated in a cognitive process which can be influenced by a broad range of psychological, social, institutional and cultural factors (*Slovic, 1992).* The risk is a "stimulus" which depends on the characteristics of the situation and at equal risk, the reactions will be different; thus, Slovic attempted to represent the risks through some factorial aggregates which could predict the actually perceived risks.

The psychometric grid was developed to identify and quantify the similarities and differences in perceptions and attitudes towards risks between groups (*Slovic & Al, 1985*). Slovic & Al adopt a widened approach of risk acceptability which integrates the perceived characteristics of the risk, breaking up the perceived risk in a multidimensional way. The citizen receives a central attention, the decision makers being confronted to the problems of risks and risky situations acceptability.

Slovic (1987) showed that these dimensions of the risk can be gathered in three factors :

- the first factor entitled "unknown" (related to knowledge) reflects the degree to which the risk is observable, known by those who are exposed to it and by scientists; it is also dependent on the immediate or differed effects from the risk and on its seniority;
- the second factor "dread" or "threat" reflects the degree to which the risk evokes a feeling of fear; it is related to the degree of perceived control, to the severity of the consequences, the exposure of the future generations and the voluntary character of the exposure to the risk; it also takes into account the potential catastrophic character, the collective or individual dimension of the risk, its equitable character or not, the possibility to reduce it, the nature of its consequences (fatal or not), its evolution in time (increasing-decreasing) and its media cover;
- the third factor relates to the number of exposed people or "the extent" of the risk.

The more the scores of the factors of “dread” and “unknown” are raised, the more the risk is evaluated as important and the more the subjects are ready to take measures to reduce them and are in favour of a strict regulation (*Slovic, 1992; Zimolong & Trimpop, 1995*).

The individuals thus do not carry out a simple trade-off between the perceived benefits; the more acceptable risks are those which are known (by those which are exposed or by the scientists), observable and which have an immediate effect; the risks having differed effects do not tend to be known by the public; the more equitable the risk is, the more it is accepted. The natural risks cause less indignation than those related to human activity. The distinction between chosen risks and undergone risks, which are not data but social constructs, is crucial to understand the individual risks representations; we better tolerate a risk that we deliberately chose to run than those which we undergo (*Slovic, 1992*).

The individuals tend to perceive less risk if they have a feeling of personal control on the situation; the risk is sometimes defined as an "insufficient control" (*Brun, 1994*); the perceived risks as voluntary are perceived as controllable. The individuals are more likely to underestimate the risks and tolerate more them if they are exposed to them in a voluntary way over a long period (e.g. in industry, *Zimolong, 1985).* Generally, they will be less concerned by the non-catastrophic risks, decreasing and natural, slightly risky for the future generations and whose exposure can be easily reduced. The individuals over-estimate the number of dead for the rare risks whereas they considerably underestimate that of the frequent and observable risks.

The recent studies confirmed that perceptions and attitudes towards risks are related to the 3 attributes of risk defined by Slovic (*Sparks & Shepherd, 1994; Raats & Shepherd, 1996; Miles & Frewer, 1999*). The authors show that the frightening character and the nature of the consequences, are closely bond to the perceived risk and its degree of acceptance by the laymen.

Other studies came to supplement the initial paradigm. Recent work revealed that the perceived credibility of the information source (*Frewer, Campion, Miles & Howard, 1997*) and the confidence into the institutions in charge of the risk communication affected the perception of the risk. The lack of confidence towards the institutions would explain the limited effectiveness of certain campaigns (*Slovic, Flynn & Layman, 1991*).

Fife-Shaw & Rowe (1996) observe that the attitudes of the public towards food risks change according to a precise cycle depending on the impression of familiarity with the risk, of sensibilization and perceptions of risk gravity. In their study on the attitudes of the public towards current food risks, the authors speak about the transitory nature of these attitudes. The problems or the activities tend to develop according to their own cycle of life, to the innovation of the activity and the uncertainties surrounding the risk. They show that the perception of the threat gravity changes in time as sensibilization or knowledge increases. For example, in the United States, attitudes with respect to the irradiation of food as new technology seem to go towards acceptance as uncertainties surrounding this technology decrease with time. Thus the education of the public and the generalized diffusion of information inevitably contribute to modify risks perceptions in the long term (*Fife-Schaw &Rowe, 1996*).

Conclusion : interest of the psychometric approach and of the study of cognitive biases for the evaluation of nutritional risks

Risks measurements such as they are developed, in particular in the marketing literature, stick more to the intensity of the risk that to its nature, without taking into account of its qualitative aspects, in particular its degree of acceptability. Measurement via the components of uncertainty and importance of the risks components lets us suppose that the individuals devote themselves to such calculations (*Bettman, 1973, Sjöberg, 1980, in: Gronhaug & Stone, 1995*). The conceptualisation of the risk inspired by the decision-making theory remains close to an analytical logic which implies for the consumer the existence of a cognitive reference framework on which to found its evaluation of risk and its capacity to think in probabilistic terms (*Raufaste & Hilton, 1999*).

Cognitive psychology showed however that the probabilistic thought is non-intuitive, unnatural (*Rozin, 1998*). This difficulty is exacerbated in food consumption by the process of categorization and the classifying thought (*Chiva, 1998; Fischler, 2001*) who lead to a simplified representation of the risk. Moreover, in contexts of new risks, the relevance of the risk concept based on calculation can be blamed because the consumer does not have the experience and knowledge necessary to evaluate the risk (*Duclos, 1996*).

According to Slovic & Al, the fact that the risk is accepted, tolerated or at the opposite causes revolt and indignation influences the consumers reactions. The psychometric paradigm highlights the fact that the subjects are not "irrational" and ignorant but have a different rationality from experts, which is qualitative and multidimensional. The public is influenced in its attitudes towards risks by a certain number of prejudices and psychosocial factors (among them the affect which is not developed in this article), which leads it to maintain its personal perceptions which are seldom confirmed by the objective probabilistic models.

The psychometric paradigm proposes an interesting analysis of individual risks perception. It had a broad success because of the simplicity of the model, of its vision close to the "common sense" and the reproducibility of data (*Sjöberg & Al, 2004*). The psychometric scales and the multivariate analysis techniques make it possible to produce quantitative representations of the attitudes towards risks (*Slovic, Fischhoff & Lichenstein, 1980*). Many studies showed that the evaluation based on subjective judgements was quantifiable and foreseeable (*Sjöberg & Al, 2004).*

This approach remains however scarcely used in consumer behaviour research except in some studies in the field of health and safety (*Rethans & Albaum, 1981; Holtgrave & Weber, 1993; Kreziak & Joly; 2000).*

This article presents the first results of a study carried out in Vietnam which aims to compare the perception of nutritional risks (malnutrition, overweight) by the mothers of school children. This comprehensive research is based on risk sociology (study of *Peretti-Watel, 2000;* psychometric paradigm of *Slovic & Al, 1979*) and on works in psychology on cognitive biases to understand the socio-psychological determinants of risks evaluation.

3. Empirical study : Application of the psychometric paradigm and of the work in social psychology to carry out a comparative study of nutritional risks perception in Vietnam

A study was undertaken in 2004 in Hanoi in partnership with the national institute of sociology (IOS) and the CIRAD[9]. It is based on the assets of the psychometric paradigm to compare the perception of two types of nutritional risks by the mothers of Hanoi : risk of malnutrition[10] and risk of overweight/obesity related to food among school-aged children from 6 to 10 years.

The prevalence of infantile malnutrition remains high and a priority in Vietnam; the prevalence of the underweight among children from 6-14 years is 32,8% at the national level (*NIN, 2003*) and 11,3% among children from 7-12 years in Hanoi (*NIN, 2004*).

The choice of the risk of overweight is related to its significant evolution in urban area, in particular among children from 6 to 10 years : the prevalence of overweight and obesity amounts to 10,4% among children of 7-12 years in Hanoi (*NIN, 2003*).

The choice of the mothers is justified because it is recognized that their practices determine the nutritional status of the children (*UNICEF, 1990*).

This work took place in Hanoi province, where a former study had already been carried out in 2002 by the CIRAD/IOS on food risks (sanitary and nutritional) perception by the households and on the perception of the links between food and health. This work shows that the consumers are overall quite informed on food-related risks and that they are more worried by the problems related to overfeeding than by those related to malnutrition. In addition, the individuals do not seem very anxious for their health because they trust in their preventive practices and have the feeling to be able to protect themselves from these risks (*Figuié, forthcoming*). It seems interesting to check these preliminary results and to go more in-depth in the analysis of the perception of these risks (malnutrition, overweight).

[9] French Agricultural Research Centre for International Development

[10] Malnutrition is defined as an abnormal growth being characterized by an underweight compared to the age according to WHO's criteria

In total, 253 mothers of children from 6 to 10 years were interviewed. The sample was constructed according to the nutritional status of the children with the assistance of the Women's Unions and the school directors of Hanoi's districts :

- 1 group of underweight children (84);
- 1 group of children having a "normal"[11] nutritional status (98);
- 1 group of overweight children (71).

Twelve agents[12] in charge of nutritional risk communication were also requested to help us to look further into mothers' logics, the constraints they face regarding food and their risks perception.

3.1. A quantitative and qualitative approach : setting in questionnaire Slovic's grid

The approach consisted in-depth interviews with the mothers on the basis of a questionnaire containing quantitative information, Likert's scales and qualitative open questions. The work was completed thanks to four interviewers of the institute of sociology of Hanoi.

First, mothers had to evaluate overall various health hazards (of which food risks) and to estimate according to the traditional model of risk analysis, the frequency, gravity and the perceived fear for their child of various food risks among which risks of malnutrition and obesity.

The perception of the two targeted nutritional risks was then declined in a certain number of perceived characteristics, defined by Slovic & Al; the questionnaire issued from the grid rests on the work of *Kirk, Greenwood, Cade & Pearman (2002*) :

Gravity, Frequency, Evolution, Fear (perceived vulnerability of children)
Possibility of reducing the risk
Control
Efficacy (personal and of the preventive actions)
Reversibility
Visibility
Equitable character of the risk
Temporality of the consequences of the risks
Responsibility
Information: mediatization, expert uncertainty, personal knowledge

In parallel was developed a general knowledge test on the causes, consequences and recommendations in concerns of malnutrition[13] and obesity.

The mothers quoted their principal sources of information (in volume) and the confidence in them.

The mothers were then questioned on the reasons of non-adopting the recommendations, with an aim to identify perceived barriers : economic, social (social reproduction, social pressure), cultural constraints (traditions), hedonic reason (taste), etc. The list of reasons was preliminary elaborated from qualitative interviews with a restricted sample of mothers.

[11] According to WHO's criteria
[12] The institutional constraints in Vietnam did not enable us to meet more experts in nutrition.
[13] The part of the test concerning malnutrition was conceived from the work of Dr. Ph¹m V¨n Phó, whose phD thesis is forthcoming .

The food practices were partially characterized from some indicators : 24hours-recall on consumed snacks, sodas, fruits; the food avoided, prohibited, reserved for the child; food preferences of the child and food consumed away from home (school, street).

The study took also into account the specific strategies implemented by mothers in order to reduce the risks as information seeking, advices given to caretakers, the involvement in a nutrition club, etc.

The nutritional status of the mothers and the children was objectified from anthropometrical measurements (weight and size), allowing to calculate the body mass index (BMI).

Complementary data on the health monitoring of the child (number of visits in health center; weightings, distance to the health center, health check-up) were collected as were some demographic data.

3.2. Data processing and first results

The data are processed using SPSS 11.0 and EPI-INFO softwares. A speech analysis was carried out on the qualitative data which were gathered by topics and pre-coded for the analysis of their frequency distribution.

The data processing is only in an initial phase and the presented results here are thus only preliminary and have to be examined more carefully.

- **Global evaluation and classification of various health hazards : importance of the food risks among health risks**

The mothers evaluated a list of 8 health hazards by sorting them by relevance in terms of consequences on health (of 1 "the most important risk" with 3) :

Alcohol abuse
Paludisme
Tobacco consumption
Bad food quality (sanitary and nutritional)
Climatic changes
AIDS
Air pollution
Insufficient food

The frequencies of the answers were balanced according to their classification. The 3 risks considered to be the most important are the AIDS, then the air pollution and finally the bad quality of the food. Thus food is an activity considered to be risky.

- Classification of the food risks according to the perceived frequency, gravity and fear for the child ; test of the basic risk analysis model (*Peretti-Watel, 2000*) : nutritional risks among food risks

Six food risks were evaluated according to the traditional model of risk analysis based on their frequency, gravity and of the fear for the child :

Malnutrition
Consumption of food containing growth hormones
Insufficient food
Consumption of food containing chemical substances
Unbalanced diet, excess of food
Consumption of "unhealthy" food (unhygienic)

The three risks considered to be the most serious are related to the presence of chemical substances in food, to the consumption of unhealthy food and then to malnutrition. The risk of malnutrition is thus considered to be serious, contrary to the risk related to an excess of food.

The three risks considered to be the most frequent are related to the presence of chemical substances in food, to malnutrition and unhygienic food. Thus, the three risks considered to be the most frequent are also considered to be the most serious.

The three risks mothers feared the most for their children are related to the presence of chemical substances in food, to the consumption of unhygienic food and then to food containing growth hormones. These first results seem to show that there is not necessarily a relationship between frequency, gravity and perceived fear. Even if the malnutrition risk is considered to be serious and frequent, it does not represent a source of fear for mothers.

The multiplicative model of risk evaluation suggested by Peretti-Watel (2000) will be tested to look further into the relations between the three components of the model and to test the assumption of independence between the variables.

- **Relationship between knowledge and practices ? Knowledge and nutritional status?**

To test the links between mothers' knowledge, their food practices of the children and the nutritional status of the children, various indices were created :

- an index of knowledge from the general knowledge test;
- a simple econometric model from the indicators of selected practices will enable us to know the weight of each one of them;
- the body Mass Index (BMI) which will be compared with WHO's criteria (*Cole, Bellizzi, Flegal & Dietz, 2000)* and with the growth chart of the CDC[14].

The first results show a good mothers' knowledge on malnutrition and obesity; all scores of knowledge are higher than the average and 47% of the mothers have a good and very good knowledge. The correlation between the BMI of the child and the knowledge's index of the mothers are very weak (0,1; p = 0,5). That seems to confirm that the level of knowledge does not make it possible to predict the nutritional status of children.

The three principal sources of information quoted according to their importance in volume are television, the magazines/newspapers and the health professionals. They are the same ones for the two types of risks. These three sources of information are those which received the three stronger scores of confidence respectively. Vietnamese thus seems to grant a great confidence with respect to the official sources and to the experts in nutrition.

- **Raisons of non-adoption of the recommendations**

In the case of malnutrition, the principal obstacles are of hedonic nature ("children do not like the taste of recommended foods; 28,9% of the mothers), of economic nature ("the recommended food are too expensive"; 17,8%), time constraints ("mothers lack of time to search for information, to cook); 19,4%) and the impossibility of personal risk control (17,4%) as well as the perceived inefficiency of the actions ("one does not see quickly the effects of recommended actions"; 15%).

In the case of obesity, the main reasons why mothers can not follow the recommendations are of hedonic type (11,1%), because of lack of control (18,6%). One new dimension seems to appear : a socio-cultural dimension through the impossibility of restricting children from eating (7,9%).

[14] US Center for Disease Control and prevention

- **Determinant dimensions of risk perception according to the risk**

Malnutrition is perceived as a decreasing risk ("there are less and less underweight children from 6-10 years old in Vietnam") whereas on the contrary overweight/obesity is considered to be increasing.

The consequences of these two risks are considered “rather” serious whereas mothers do not perceive any fear or low fear.

Mothers estimate that it is “rather” easy to reduce these two risks. Perceived control is “rather” important or total in both cases and mothers consider their food practices “rather” efficient even totally efficient to fight or prevent these two risks.

The consequences in the time of obesity are perceived as rapid (few weeks) whereas those of malnutrition are perceived “rather” in the long run (few months).

The two risks are considered to be equitable (all the children are exposed in the same manner) but mothers consider obesity and overweight less equitable than malnutrition. According to conclusions of former works on risk, it seem that malnutrition risk could be better accepted than obesity risk ?

The maternal responsibility is considered to be more important in the case of malnutrition. It appears from the qualitative talks that the child is considered as responsible in the case of obesity.

The perceived mediatization of the risks is "rather" important but it is higher in the case of the malnutrition, probably because the problem of obesity is quite new in Vietnam. This appears also regarding the perceived scientific uncertainty, which is weak for the two risks but more important for malnutrition ("the scientists know perfectly the risk of malnutrition").

The mothers evaluate their knowledge "rather" good on the causes, consequences of malnutrition and obesity. They estimated themselves "rather" informed on the recommendations regarding malnutrition but "little" informed about the measures towards obesity. The recommendations emanating of the health ministry are considered to be rather easy to implement, concrete and efficient for the two risks. It may be possible to correlate these results with the high confidence in the official sources of information. One should not however neglect interviews’ biases as the work was undertaken with the Women’s union, connected with the Vietnamese Communist Party.

These first results give an overview of the answers but a more detailed analysis of the data will make it possible to test the correlations between variables, to release the differences in structure between the risks and to make a typology of the mothers according to the perceived characteristics of the risks.

- **Cognitive biases, optimistic biases, knowledge biases**

The studied cognitive biases are :

- the knowledge bias : difference between perceived and real knowledge of the mother; it seems that this shift is weak, the mothers having the (right) feeling to know well the risks;
- the perception bias of the nutritional status of the children : gap between perceived and real (measured) nutritional status of the child;
- bias when evaluating the probability of occurrence of the risks : difference between perceived and real frequency of the risks.

The results show the tendency of the mothers to underestimate the risk of malnutrition in Vietnam (66% of the mothers) and in Hanoi (39%). At the opposite, the mothers over-estimate the risk of obesity in Vietnam (96%) and Hanoi (70%). Thus, they evaluate

differently the extent of the two risks and are prone to biases when estimating the risks, which would confirm the results of an empirical work on cognitive biases described previously.

These results are preliminary and the data processing must be continued to test the relationships between the various components of the model, knowledge, BMI, perceived risks characteristics, practices and the influence of the socio-economic data.

Discussion and conclusion : contributions and limits of the psychometric approach and proposals for prolongations

Many papers highlighted that the public has its own way of apprehending uncertainty and that it has a perception of the risks more complex and qualitative than the experts. The shifts observed between the recommendations on nutrition and health and food behaviours would not come from a deficit of communication but would be related to a difference of rationality from the actors (expert, profane).

The psychometric approach asserts that the evaluation of the risk by the citizens is not irrational but conducted by a different rationality than that of the experts, integrating a greater diversity of criteria and considerations on the possible risks and advantages. It makes it possible to identify the characteristics influencing the individual risk perception, apart from the probability of threat and the importance of the consequences, while postulating that the risk is inherently multidimensional.

It is in this logic and by adopting a psychosocial multi-disciplinary approach that was developed, in the present research, a psychometric questionnaire adapted to nutritional risks. It was tested in Hanoi (Vietnam) within the framework of a comparative study of the perception of the risk of malnutrition and risk of obesity by the mothers of children from 6 to 10 years. The first results show differences in the importance of the perceived dimensions of nutritional risks. The continuation of the data processing will make it possible to go further in the analysis and the comprehension of the psychosocial determinants of the risks evaluation and to highlight potential cognitive biases.

The psychometric techniques seem to be well appropriate to identify the similarities and differences between the groups of the attitudes towards risks. However the model meets some limits.

A weakness of the psychometric studies relies on the fact that the factors which influence the evaluation of the risk become trivial when the subject is confronted to current risks. *Howard (1988*) suggests that conscious verbal knowledge generally refers to social stereotypes; on the contrary, the answers about usual activities are controlled by the tacit knowledge which underlies usual behaviours. The majority of decisions in everyday life are not conscious decisions. However, the psychometric experiments fall under a theory of deliberated choice, whereas the individual answers in risky usual situations (as food act) are more the result of learned practices which are automatic.

Moreover, if the data are analysed in an adapted way, the model counts at least for 20-25% of the variance of the perceived risk and the risk tolerance (*Sjöberg & Al, 2004*); but the explanatory capacity of the model is largely due to the factor of fear (“dread”); however, it is probably more one consequence of the perceived risk than a cause of it and it could not thus be used as an explanatory variable ?

The characteristics of the risk do not take into account the emotional dimension of the attitude (affective component) and does not allow us to know how people react affectively to the risk; *Loewenstein, Weber, Hsee & Welch (2001)* proposed an assumption of "risk-as-feelings" underlining the emotional experiences at the time of the decision-making; they show that the emotional reactions with respect to risky situations often diverge from the cognitive evaluations of these risks; the answers are influenced by the emotions like feelings, concern, fear or anxiety. There is a moderate and consistent relationship between emotional reactions and risk perception (*Drottz-Sjöberg & Sjöberg, 1990*); however, the attempts to integrate items to measure the emotional reactions do not seem to add explanatory capacity to the model (*Sjöberg & Al, 2004*).

The psychometric paradigm postulates that all individuals evaluate the risk according to the same universally shared characteristics. Apart from distinguishing expert-laymen, it does not try to make a distinction between individuals or groups (*Marris, Langford, Saunderson & O'Riordan, 1997)*. It treats the risks, activities and products like "*external objects with a preset whole of qualities and disadvantages and is unaware of the possible influence of the social, cultural and institutional factors on the comprehension and the evaluation of the risk by the individuals*" (*Marris & Al, 1997).* However, the "profiles" of risk are not universal and the individuals will attribute various characteristics at a same risk. The psychometric model thus does not consider the social construction of risks. It postulates that the risks would be only psychologically perceived by the agents.

In order to explain the social determinism of perception, the cultural theory (*Douglas & Wildavsky, 1982; Dake, 1991*) and the theory of the social amplification of the risk *(Kaperson, 1992*) postulate on the contrary that individuals can never be separated from their social and cultural environment and are conditioned by social or cultural biases; it is in the external factors that they seek the causes of the individual selections and definitions of risk. It seems that there is a medium between psychological determinism and sociological determinism and that the individuals apprehend the risk according to psychological and social factors at the same time. The concept of risk lays down the problem of knowledge; there is no knowledge without representations, signs to interpret reality, which must necessarily pre-exist to the subject, formed from the intersubjectivity, the relations between agents, their history, culture, etc; these representations are the product of a process of social construction of reality (*Van Nuffelen, 2004*).

It seems interesting to bring closer the psychometric approach and the cultural theory, to analyse risk perceptions and their construction from a social and cultural point of view. This approach is based on specific assumptions on the structure of the group (the "grid") and its function (the "group"); it postulates that the process of risk perception is determined by norms, systems of social values and cultural idiosyncrasies of the societies called "cultural biases", which return to perceptions or the "views of the world" (political, cultural, social). It is from the organization of this knowledge, since childhood, that the individual perceives and gives sense to the surrounding world. Thus, the individuals do not share the same conception of knowledge and of the legitimate conditions of its production : for some people, the scientific knowledge is issued from a slow process of collective accumulation within recognized institutions (institutional expert)s; for others, it is based on isolated individuals (independent experts). The attitude of one individual regarding a risk will thus depend on the sources of information that the person privileges and of the perceived legitimacy of the institutions (*Douglas & Wildavsky, 1982; Douglas & Calvez, 1990; Marris, 2001*). Moreover,

to these various cultural poles correspond various designs of the body and the physical vulnerability, which they would be important to consider in the case of health hazards.

Following the work on risks, new models have been developed in Western countries in the 1980's, recognizing the duality between expert and public in their risk evaluation, and drawing up new relationship between experts and laymen. The resulted model of risk analysis, qualitative and participative, is described as "constructivist", compared to the standard, "positivist" and quantitative model (*Chevassus-Louis, 2000*). The researchers in social sciences then wondered about the way in which the societies face, perceive and interiorise the risks. The stress is laid on the social impacts of the risks and the catastrophes and not only on the mechanisms which chair the hazards (probabilities of occurrence of the risk). The risk then becomes a revelatory indicator of the functionment of the societies.

This model tries to integrate principles of ethics, justice, responsibility : the individuals are regarded as mainly responsible for the management of their health hazards, since many risks were characterized as behavioural in their origin and largely under individual control (*Chevassus-au-Louis*, 2000). This new design asserts the implication of the citizens in the risk management and is interested in the representation the agents have of the various interactions in which they are committed. It recognizes that the reactions of the public towards risk have their own rationality and that the prospects of the "experts" and the "laymen" should light mutually according to a bilateral process (*Bennett, 1999*).

However, this new approach has perverse effects. First at all, the technical and scientific data are in general difficult to reach for uninitiated public, which cannot take part in the debate. Moreover, the attempts to integrate the citizens in the risks debate (citizen conference on GMO for example) seem only one means of legitimating the action of the authorities and the profane vision is not taken into account.

The work undertaken by Slovic & Al reduce the problematic of risk acceptability to an adjustment of security effort to the reactions of the populations, which are imputed to the feeling of "undergone risk"; it is a question of making acceptable not the activity but the set of the risks it involves *(Pagès, 1999*). The integration of individual perceptions in the risks evaluation is seen like a means of improving confidence of the public towards recommended measurements. One thus always remains in a utilitarian logic and a very mechanist vision of the individual behaviour, which tries to understand the characteristics of the risk perception with an aim of influencing them and of returning the risk and considered measurements as acceptable. "*As the representations of the public started to affect the decisions of the policies, the question of acceptability became mediatic : it is necessary to communicate, inform the opinion, for making a risk acceptable or unacceptable*" *(Peretti-Watel, 2000*). The problem remains to know how to modify the behaviours by integrating psychological factors and the existing social practices.

These reports raise several questions. How to exceed the linear and reducing traditional approach of individual rationality and behaviour ? How to balance the role of the various actors, scientists, politics, industrials and experts, in the debate on health risks and to make so that the public becomes a real partner of the negotiation on the risks acceptability ? Which would be the modalities of participation of the citizens in the debates on health ? What would that imply in the case of nutritional risks ?

The risk became a stake of the debate on the activities implying various actors and divergent interests. The public controversies emanating from the divergences of perceptions and interpretations call into question the distribution of the powers in the decision-making process and disturb the establishing hierarchies. But the procedures can become socially acceptable only if the official managers agree to enter the play of the transparency and of public criticism and the problem resides in the organization of the partnership between the various parts.

These "constructivist" models fall under contexts of increasingly deliberative democracy, which want to be respectful of the powers and counter-powers and which evolve to the confrontation of the points of view of all the actors to understand the conflictual reality of the society and to lead to socially and economically optimal decisions. Nevertheless, a truly deliberative and interactive citizen participation is only possible within a real democratic environment.

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