REPORT to MORI GRANT

TITLE: Wealth and /or Health: Farmers' Decision-making under Risk in the cases of Vietnam and Laos

Vu Le Thao Chi, Ph.D. Candidate
School of Media and Governance
Shonan-Fujisawa Campus
Keio Univeristy

1. PURPOSE:

As the use of agrochemicals (including pesticide[1]) in farming increases, their negative impacts on human health have also become a key concern among the producers, the consumers and the policy makers. The research examines the behaviors of the farmers in developing countries under especially greater pressure for higher productivity such as Vietnam and Laos, those who are directly involved in the pesticide practice. The focus of the examination is the famers' choices concerning means which may promote wealth and/or health.

2. RESEARCH BACKGROUND:

1. Pesticide Use -- Benefits outweigh Costs?

Every year, worldwide, about three billion kg of pesticide is applied with a purchase price of nearly $40 billion[2]. This resulted in 26 million cases of non-fatal pesticide poisonings, of which 3 million cases are hospitalized and there are approximately 220 000 fatalities and about 750 000 chronic illnesses every year[3]. Besides, it is empirically and scientifically supported that there exists a correlation between the use of pesticides and chronic health effects on human being including neurological effects, respiratory and reproductive effects, and cancers.

Historically, the use of over 21 million gallon of herbicides known as Agent Orange during the Vietnam war, 1961-1973 by the US on the South of Vietnam, part of Laos and Cambodia produced tremendous adverse effects on the environment and on human health. The war-time of this agrochemical resulted in roughly 5 million victims in Vietnam alone.

In the US, a combined human health and environmental cost from peace-time use of pesticides is $9.6 billion annually, of which human health cost is $1.1 billion, based on a study by David Pimentel[4]. The increase of the use of pesticides may be attributed to the simple fact that the US annual investment of $10 billion in pesticides (about 500 million kg of more than 600 different pesticide types) is viewed as saving approximately $40 billion in US crops in return[5], four times higher than the cost on human health and environment.

In an attempt to mitigate the risks involved in the pesticide practices, Food and

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[1] Pesticide or agro-chemical includes insecticides, herbicides, fungicides, plant regulator, defoliant or desiccant, intended for preventing, destroying or controlling any pest

[2] PAN-UK, 2003, Current Pesticide Spectrum, Global Use and Major concerns, http://www.pan-uk.org/briefing/SIDA_Fil/CHap1.htm

[3] Pimentel, David, 2005, Environmental and Economic Costs of the application of pesticides primarily in the United States, Environment Development and Sustainability (2005) : 229-252

[4] Pimentel, 2005

[5] Pimentel, 2005

Agriculture Organization published the International Code of Conduct on the Distribution & Use of Pesticides, an internationally recognized guidance document and served as a voluntary standard and point of reference for sound pesticide management practices, in 1985 (updated in 1989 and revised substantially in 2002). The management practices cover thoroughly all stages including registration, supervision,labeling,marketing, instructions, among others. Together with the Rotterdam Convention on the Prior Informed Consent Procedures (PIC) for Certain Hazardous Chemicals and Pesticides in International Trade (which went into effect in 2004), the Code serves as the basic foundation for the sustainable practices for agricultural production. However, how it is realized in reality is a different story.

2. The cases of Vietnam and Laos:

Vietnam and Laos share a great deal of similarities. Both are agricultural countries with the large agricultural populations (53.9% and 75% of the total respectively) and the agricultural shares accounting for 20% and 30% of total GDP respectively. Vietnam and Laos walked out of war in 1975, and soon after that, carried out across-the-board reforms also in the same 1986. The agricultural sector has been given prominent roles in the reforms for transforming their economies to market economies. Land reforms, again almost launched simultaneously in the early 1990s, are considered key to stimulating agricultural production.

Similarities may end here. Political and other conditions may account for the differences. While in Vietnam the advanced input for agricultural production including chemicals, new varieties and machineries was first introduced in 1960s(mainly from Soviet and China), Laos is considered "a latecomer to green revolution" (not until 1990). While Vietnam is among the leading exporters of many agricultural products like rice, cashew nuts and so on, Laos is still trying to secure the goal of "food sufficiency" especially for the poor upland in the north. The gap seen in the agricultural production between the two countries is also observed in the levels of pesticide consumption. The intensity with which the chemicals are used in Vietnam -- for example, the pesticides use per hectare of agricultural crops -- doubled between 1990 and 1999. Over 90% of the pesticides sprayed were insecticides, many of which fall under World Health Organization's categories I and II, classified as extremely to moderately hazardous. Laos, on the hand, consumed much smaller amount of pesticides ($100,000 in 2002[6], one sixth of Cambodia and one one-hundred-and-seventieth of Vietnam[7]. This amount, however, still shows a sharp increase of 30% within less than 10 years (1995-2002) and does not yet include the large amount of chemicals illegally imported through informal channels from Thailand, China and Vietnam. While the health cost from pesticides is not clear (on record) in the case of Laos, it has

[6] http://www.fao.org/docrep/008/af340e/af340e0c.htm retrieved on April 28, 2011

[7] FAO, "The path to pesticides…? A case study on Trends and Tendencies in the Lao PDR," 2004

been well studied in the case of Vietnam. In 2006, the World Bank reported that the costs of chemicals-induced health and other damages in Vietnam surpassed $1 billion a year, accounting for 2% of total GDP (2006), $57 billion[8] Every year, about 66,000 cases of food poisonings are reported and it is believed that there 50 cases unreported for every reported case. Besides, Vietnam has been burdened with the costs related with approximately 5 million Agent Orange victims from the exposure to Agent Orange/ Dioxin, a kind of herbicide that the US sprayed over Vietnam during Vietnam War (1961-1975). It is puzzling that the legacy of the war-time use of toxic chemicals seems to play very little role in influencing the famers' use of the agrochemicals.

3. Significance of Research:

Abuse or misuse of pesticides or other chemicals by the farmers in developing countries such as Vietnam and Laos poses the serious threat not only to their economies but also to the societies. This is one of the reasons why the examination of the farmers' behavior is urgent. However, as I discussed elsewhere[9], the famers are not uniformly irrational or ill-informed of the conditions under which they must make important decisions. It is important to understand clearly how the famers behave the way they do, instead of slighting their decisions simply as irrational. This is another reason why this research is important.

3. CURRENT STATUS OF RESEARCH

1. Observations and Puzzles:

Depending upon the risk awareness level of farmers, preventive actions are believed to be taken accordingly. The awareness of risks includes the understanding of "how serious the threat is" and "how susceptible that individual is to the threat" (i.e., am I going to get ill), in which the former is the necessary condition and the latter sufficient for changes in individual behavior given a health risk. Findings from the observations, nonetheless, do not show much of a relation between the level of awareness and corresponding preventive action.

The two behaviors under examination are 1) reproductive behavior especially among the parents of the Agent Orange victims, the farmers who are most aware of the risk for having additional Agent Orange-affected member(s) to their households; and 2) the use of pesticides.

[8] "Vietnam Food Safety and Agricultural Health Action Plan," Document of World Bank, 2006, Report no. 35231 VN, p.xii.

[9] "Risk and Farmers in Transitional Rural Societies: Cases of Laos and Vietnam," currently under review for publication.

Finding 1: 68 families (out of 91 Agent Orange victims interviewed) decided to have at least one more child after the first handicapped (affected) child and 22 families decided to have at least 2 more children after the second handicapped child.

Table 1 Effect of Birth Defects-1

(The number of children after the ***first*** handicapped child)

	0	1 child	2 or more	NA	Total
Phu Cat	11	14	19	4	48
Thanh Khe	3	7	5	0	15
Kim Bang	4	4	19	1	28
Total	18 families	25	43	5	91

Table2 Effect of Birth Defects-2

(The number of children after the ***second*** handicapped child)

	0	1 child	2 or more	NA	Total
Phu Cat	5	4	1	0	10
Thanh Khe	3	1	1	0	5
Kim Bang	2	7	8	0	17
Total	10 families	12	10	0	32

Finding 2 (among 9 commercial farmers in Cat Trinh commune[10], Phu Cat, Binh Dinh): These 9 families are involved in growing cashew nut trees since early 2002. After harvest time, they sell cashew nuts to middle-men (about 6-7 of them in this commune). This growing activity requires constant care towards the trees especially in January, the month of pollination, a month before harvesting. A large amount of fertilizers and pesticides is used in this month. However, the way they use chemicals varies. Four hire others to do spraying. Five spray by themselves. Approaches to the chemicals differ within these five:

No.1 Spray only for his farm
No.2 Considered as "professional sprayer". He sprays for at least other 8 families
No.3 Discreetly bought chemicals used to soak mosquito nets at high price and believed it is a great know-how
No.4 Used chemicals only for young trees because he does not have enough money
No.5 Used chemicals but not that attentive to the farm since rice farm is more

Attention should be given to the farmer No.2, "the professional sprayer". He does spraying for himself and also other eight families for fee. He says: "Those who have money are afraid of getting sick and therefore hire me to do spraying for them. I am afraid of getting sick, too but ... I need money to support my children". He wears a coat, helmet, gloves and mask while doing

[10]These farmers are aware that the mountain near where they live is Dioxin-contaminated and have the knowledge of the presence of Agent Orange victims in their surroundings.

spraying. But when it gets too hot, he just takes off his shirt. He, therefore, experienced skin rash sometimes.

Finding 3 (among farmers in Savannakhet): Low use of pesticide is not resulted from high awareness of risk. The percentage of using chemicals is low. Pesticide related health issues are still not a concern for none of them since few of them experience serious health problems as well know any actual case of similar conditions. Some reported that they are worried about their health to justify their not using chemicals for their farm, but later said that no use is because of no bug seen in their farm. 4-5 cases reported using Folidol, which is a banned chemical, to kill crabs even though at first they claimed that they did not use any kind of pesticide. To them, crabs are not "insect" harmful to their produces.

Number of farmers using fertilizer	31/57 (54%)
Number of farmers using pesticide	28/57 (49%)
Number of farmers using both	6/57 (1%)
Number of farmers reporting health problems (rash, dizzy, headache..)	6/57 (1%)
Number of farmers knowing about acquaintances who experience health problem	6/57 ((1%)
Number of farmers know about Agent Orange:	3/57 (0.5%)

2. Exploration of Analytical Frameworks:

There are several analytical frameworks which may be useful for understanding the behavior of these farmers. Many of these analytical frameworks generally treat the farmers exclusively as producers of agricultural produces, while they differ from each other on the motivational and other bases of their productive activities. The central question remains how they behave rationally under given circumstances.

Moral or Rational Farmers: James Scott in his Moral Economy of the Peasant(1976) calls attention to the farmers' view that their individual gains lie in the promotion of communal well-being. In other words, they behave in such a way that their individual interests do not conflict with communal interests. By contrast, Samuel Popkin's 1979 counter-argument Rational Peasants offers that the farmers are first and above all committed to maximizing their gains, independent of collective interests. These two works share one point that they both assume expected utility maximization – efficient production -- as the foundation for farmers' behaviors. A question remains whether or not the farmers' lives are wholly committed to production only.

Farmers as Consumers: If we view the farmers as consumers, their behavior may reflect different bases. As consumers, farmers face more than one choice at a time. This shift in perspective should help shed a light on the reasoning behind allegedly irrational or ignorant behaviors of farmers, especially under risk situation. This new perspective places the farmers in a contrasting position to the more conventional perspective where the farmers are subjected to

more than one conflicting prescription for the behavior by disparate groups of "experts" such as plant protection specialists, medical specialists, soil and water specialists among others. If the farmers were to follow all these prescriptions, they can only show contradicting behaviors – a cause leading some of these experts to characterize farmers irrational -- or need to cease to be farmers. It is this perspective, that the famers do more than just producing agricultural products, which is necessary for understanding the behavior of the farmers in question.

Take the following as an example of farmers in the new perspective: The items of goods that the farmers need to choose can be broadly divided into those that promote one type of gains, wealth, and the other, health. Wealth is the value gained from the investment in production inputs such as land, agro-chemicals, machines, and labor, among others and Health is the value gained from the investment in health insurance, protection measures, and regular checkup, among others. Consumer choice theories emphasize the utility or value gained from the consumption of the acquired goods as a decisive factor influencing the consumers' decision-making.

Consumer Choice Theories: First, in the **Expected Utility Theory**, there is the assumed conversion of the expected value of the goods claimed by their sellers or makers and that perceived by the consumers. Within this broad framework, "satisficing" and Bounded Rationality (Herbert Simon) arguments emphasize the incomplete information and the limited cognitive ability of consumers that prevents them from maximizing the expected utility of the purchase, thus leading to "compromised" choices (satisficing). One problem of these arguments may be that the consumers do not take into consideration of probable deviation from their expectations. How do the consumers behave if and when the choices are presented with the probability either of gains and/or of losses, i.e., the chances of the deviation from the expected value are high?

The life of the farmers in my research is not that different from ours in the sense that it is not consumed solely by one concern but many, and that the expectations need to be constantly re-examined and adjusted. Given this simple point, another of consumer choice theories is immensely helpful. The theory, which has gained a large support among public health practitioners as well[11] is **Prospect Theory**, developed by Nobel Prize (for behavioral economics) winners, Daniel Kahneman and Amos Tversky as an alternative approach to farmer's behaviors under risk.

Prospect Theory: What follow is a brief examination of how helpful this theory can be for the analysis of the farmers in question. There are several key terms in this theory. .

Decision weight (subjective probability): measures the impact of events on the desirability

[11]See for example http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2892380/

of prospects, and not merely the perceived likelihood of these events. Decision weight, rather than stated probability, attached to an eventcould be influenced by other factors, e.g. lack of information.

Value Function: Carriers of value are changes in wealthrather than final state of wealth (assets).

Reference Point: One's current asset position from which gains and losses are coded relative to an expectation or aspiration level. And it differs from the status quo. Reference point can change because of changes in wealth that the decision-maker experiences. It alters the preference order for prospects. This is the most advanced point of Prospect Theory compared with Expected Utility Theory.

A brief application of the theory in analyzing the findings:

Behavior 1: Reproductive behavior

The situation presents a zero-sum game. Farmers (Agent Orange group) are in a high risk group, meaning that they are likely to have a handicapped child.

(I)Prospects (offered by Medical experts)

*Notations

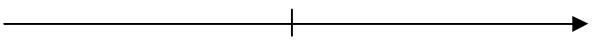
Value of having a healthy child (X): 1

Value of having a handicapped child (Y): -1 (assuming that these families give higher value to having a normal child since they experienced the loss of a normal child)

	Choice A	Choice B
Probability (p)	[1,.20; -1,.80] (20% having a normal child, 80% having a handicapped child)	[0] (not have a child)
Expected Utility (U) U = (X.p1 +Y.p2)	1x1/5 + (-1)x4/5 = - 0,6	0
Preference		Choice B

The reference point in this prospect is 0.

losses 0 gains



However, to these farmers who desire to have a child, the value of "not to have a child" is just as low as the value "having a handicapped" which is (-1)

(II) Prospects ("edited" by the farmers)

	Choice A	Choice B
Probability (p)	[1,.20; -1,.80] (20% having a normal child, 80% having a handicapped child)	[0] (not have a child)
Expected Utility (U) U = (X.p1 +Y.p2)	1x1/5 + (-1)x4/5 = - 0,6	-1
Preference	Choice A	

The reference point in this edited prospect is 1 instead

losses 1 gains

Choice A, as a result, is preferred for its higher utility and therefore is rational.

Behavior 2: "Abusing agro-chemicals" (using without care) as oppose to "using with care"

This behavior is observed among commercial farmers in Vietnam, who live in the Dioxin contaminated area and are aware of the presence of some Agent Orange victims in their communities and some farmers in Laos who are becoming used to the idea of using toxic agro-chemicals (Folidol) for their farm.The use of toxic chemicals has impacts on both Wealth and Health, and in some cases (excessive use of toxic agro-chemicals) will turn Wealth and Health into mutually exclusive goods (gaining wealth at the high risk of losing health.)

(III) Prospects offered

	Health		Wealth	
Value	-1	0	0	1
	Sick	Healthy	Poor	Rich
Abuse (C)	70%	30%	0%	100%
Use with care (D)	0%	100%	40%	60%
Utility of (C) in each area	-0,7		1	
Utility of (D) in each area	0		0,6	
Preference in each area	Choice D		Choice C	
Utility of (C) considering both Health and Wealth	0,3			
Utility of (D) considering both Health and Wealth	0,6			
Overall Preference	Choice D			

*Notations

Value given to being healthy: 0 (assuming that health is measured in terms of losses, than gains. These families

have not experienced serious ailments from the encounter with chemicals, therefore being healthy is seen as a matter of fact, resulting in [0] for value of being healthy)

Value given to becoming sick: -1

Value to being (remaining) poor: 0 (assuming that wealth is measure in terms of gains, than losses)

Value to becoming rich: 1

However, from their own experiences, these farmers have not experienced any serious signs of ailments but just some skins rashes, headache when they use chemicals without any protection measures.But those signs are considered minor and temporary. So the chance of becoming sick in case of abusing chemicals is 20% right now and of becoming really sick in the future is less than 50%. We have the edited prospects as follows.

(IV) Edited Prospects 1

	Health		Wealth	
Value	-1	0	0	1
	Sick	Healthy	Poor	Rich
Abuse (C)	50%	50%	0%	100%
Use with care (D)	0%	100%	60%	40%
Utility of (C) in each area	-0,5		1	
Utility of (D) in each area	0		0,4	
Preference in each area	Choice D		Choice C	
Utility of (C) considering both Health and Wealth	0,5			
Utility of (D) considering both Health and Wealth	0,4			
Overall Preference	Choice C			

There are cases in which health realm is omitted in the consideration of the farmers when the chance of becoming sick is underestimated or equated with the chance of staying healthy. The reference point goes from (being health and rich or being poor and sick) to only (being rich or being poor) as follows:

(V) Edited Prospects 2

	Health		Wealth	
Value	-1	0	0	1
	Sick	Healthy	Poor	Rich
Abuse (C)	50%	50%	0%	100%
Use with care (D)	0%	100%	60%	40%
Utility of (C) in each area	-0,5		1	
Utility of (D) in each area	0		0,4	
Preference in each area	Choice D		Choice C	
Overall Preference	Choice C			

In both edited prospects, Choice C is the preferred choice for its higher utility expected by

the decision-maker.

The research is expected to evaluate farmers' behaviors, not in terms of the outcomes of their choices, but in the process of making the choices. The prospect approach, in that light, helps illuminate which stage in the process may lead to the final choices, whether it is risk-seeking or risk aversion. Also, this approach can help specify what can be done to bring farmers' expected utility closer to the expected utility stated by,for example, development planners eager to minimize the cost of agricultural development. For instance, how to increase the value of being healthy from (0) to (1) even among the low risk group, thereby Choice D (use with care) is always the preferred choice in all cases. Similar approach should be considered in Laos at this early stage prior to the fact that wealth and health will become mutually exclusive goods.

Further refinement or adjustment in using Prospect Theory is necessary. However, with the insights from this economic theory, the research gain a new perspective for the farmers in developing countries, who are more than a "production factor" whose behavior has often been evaluated solely in terms of their ability to raise agricultural productivity.

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