A Collaborative Research Project Funded by:

DFID Department for International Development

Implemented by:

HPAI PRO-POOR HPAI RISK REDUCTION
HIGHLY PATHOGENIC AVIAN INFLUENZA

Impacts of HPAI on Rural Livelihoods: Conceptual and Analytical Frameworks

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Africa/Indonesia Team Working Paper No. 10

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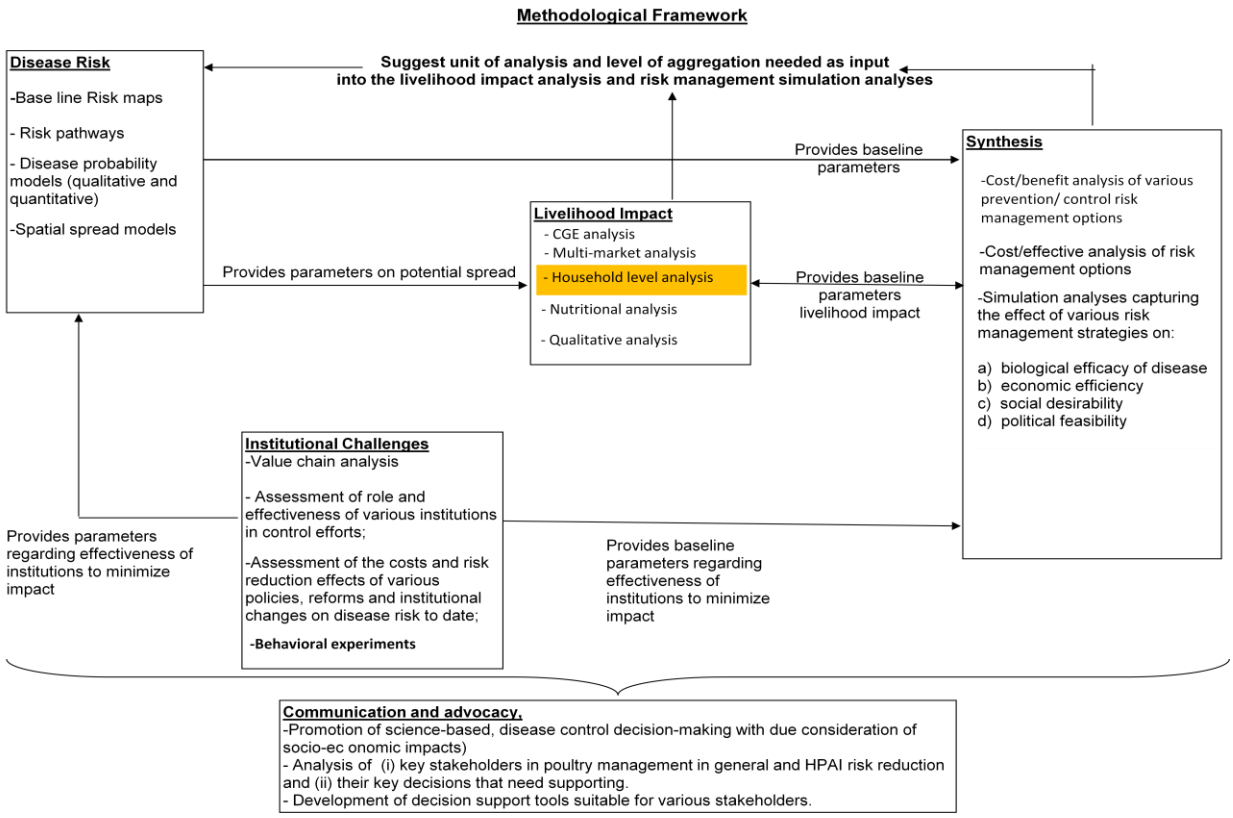
Preface

Since its re-emergence, HPAI H5N1 has attracted considerable public and media attention because the viruses involved have been shown to be capable of producing fatal disease in humans. While there is fear that the virus may mutate into a strain capable of sustained human-to-human transmission, the greatest impact to date has been on the highly diverse poultry industries in affected countries. In response to this, HPAI control measures have so far focused on implementing prevention and eradication measures in poultry populations, with more than 175 million birds culled in Southeast Asia alone.

Until now, significantly less emphasis has been placed on assessing the efficacy of risk reduction measures, including their effects on the livelihoods of smallholder farmers and their families. In order to improve local and global capacity for evidence-based decision making on the control of HPAI (and other diseases with epidemic potential), which inevitably has major social and economic impacts, the UK Department for International Development (DFID) has agreed to fund a collaborative, multidisciplinary HPAI research project for Southeast Asia and Africa.

The specific purpose of the project is to aid decision makers in developing evidence-based, pro-poor HPAI control measures at national and international levels. These control measures should not only be cost-effective and efficient in reducing disease risk, but also protect and enhance livelihoods, particularly those of smallholder producers in developing countries, who are and will remain the majority of livestock producers in these countries for some time to come.

To facilitate the development of evidence based pro-poor HPAI control measures the project is designed so that there are five work streams: disease risk, livelihood impact, institutional mechanisms, risk communication, and synthesis analysis. Project teams are allocating and collecting various types of data from study countries and employing novel methodologies from several disciplines within each of these work streams. So that efforts aren't duplicated and the outputs of one type of analysis feeds into another the methodologies in each work stream will be applied in a cohesive framework to gain complementarities between them based on uniformity of baselines and assumptions so that policy makers can have consistent policy recommendations. The figure below is the methodological framework used to depict how work stream outputs fit together. This brief discusses the methodologies to be used when conducting the livelihoods impacts highlighted in the methodological framework below.



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Acknowledgements

We would like to thank Ian Hodge, Clare Narrod, Devesh Roy and Maximo Torero for valuable comments and suggestions and for fruitful discussions.

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More information

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1. Introduction

Seventy percent of the world's rural poor depend on livestock as a component of their livelihoods (LID, 1999; FAO, 2002), and a vast majority of those keep poultry (Sonaiya et al., 1999; Epprecht et al., 2007). Village poultry production, which is also known as backyard extensive poultry production, is a common phenomenon in many developing countries. This mode of poultry production is characterised by ownership of up to a hundred birds; generally reared free-range, with minimum or low inputs and zero to minimal biosecurity (Guèye, 2000; Kondombo et. al., 2003; Muchadeyi et. al., 2005; Abubakar et. al., 2007). In fact among the rural poor, poultry is found to be a crucial livelihoods asset for the poorest segments, such as those households that are in the first income quintile (Maltsouglou and Rapsomanikis, 2005; Roland-Holst et al., 2007).

Poultry production by rural poor households contributes to several livelihoods indicators, including (but not limited to) income, nutrition, food security, savings, insurance and gender equality (Campbell and Tretcher, 1982; Watts, 1983; Sonaiya, 1990; Sonaiya and Olori, 1990; Chitukuro and Foster, 1997; Kitalyi, 1998; Kushi et al., 1998; Sonaiya et. al., 1999; Guèye, 2000; Sonaiya and Swan, 2004; Muchadeyi, 2005; Alabi et al., 2006; Abubakar, 2007; Guèye, 2007a; 2007b; Sonaiya, 2007; Smucker and Wisner, 2008). Furthermore poultry production constitutes a quick and high return investment opportunity (Epprecht et al., 2007; Sonaiya, 2007) for improving any one or all of these livelihoods indicators. Moreover, poultry production is often recognised as an entry point into livestock production (Alabi et al., 2006; Guèye, 2007a), which is associated with breaking out of poverty traps.

The roles of poultry in income and food security are straightforward to characterise: rural poor households generate cash income through the sales of those poultry and poultry products (e.g., eggs, meat, feathers) which they do not consume themselves. With the income generated through these sales they are able to buy other types of food and/or inputs to produce other types of food (e.g., seeds to produce grains). Contribution of poultry to other livelihoods indicators, namely savings, insurance, nutrition and gender equality, however, requires further elaboration.

In rural areas where credit markets are missing, similarly to other large livestock, poultry functions as 'insurance' to hedge against shocks and stresses (Binswanger and McIntire 1987; Rosenzweig and Wolpin 1993; Fafchamps, et al., 1998). Often poultry functions as a 'savings account', which can be tapped into fairly quickly to meet household needs such as school fees, costs of weddings and funerals (Obi et al., 2008). Poultry represents a store of value which appreciates very quickly with time, as demonstrated by the high productivity parameters estimated for village/backyard extensive poultry across developing countries (Sonaiya, 1990; Kitalyi, 1998; Sonaiya and Swan, 2004).

Poultry also contributes to household nutrition, as many rural poor households rely on their own poultry production to supply the majority of their animal source food. Poultry provides not only protein but also highly-bioavailable essential micronutrients, such as iron, Vitamin A and zinc, which are crucial especially for child nutrition and health (Iannotti et al., 2008). Chronic malnutrition and micronutrient deficiencies are very high in developing countries (Quinn et. al, 1990; Callens and Phiri, 1998) and hence poultry is particularly important for the improvement of this livelihoods indicator. In fact several ongoing projects in developing countries, especially in African countries, are

encouraging livestock production, particularly poultry production as a nutritional intervention (Narrod, 2006).

Finally, village poultry or backyard extensive poultry production is important for empowering women and promoting gender equality in developing countries. In most developing countries village poultry or backyard extensive poultry are mainly owned and/or managed by women, providing them (as well as those they look after including children, elderly and the invalid) with livelihoods (nutrition, food security, income, wealth, and consequently empowerment) and hence contributing to gender equality. In fact World Hunger Project lists poultry as one of the new income earning activities in which women are increasingly being involved (The World Hunger Project, 2005). In Africa for example, women are widely recognized to be the main poultry keepers, constituting over seventy percent of all poultry ownership (Alder, 1996; Guèye, 1998; 2000; Kitalyi, 1998; Sonaiya, 2007). Household level studies conducted in Africa revealed that women earned significant incomes from poultry sales, even after accounting for household consumption (Chitukuro and Foster, 1997; Kushi et al., 1998, Alabi et. al., 2006). Similarly, in Indonesia, amongst all livestock types, women are most likely to own poultry, and within households women are as engaged as men (if not more) in all aspects of poultry rearing (Asare-Marfo and Birol, forthcoming).

Recent outbreaks of Highly Pathogenic Avian Influenza (HPAI) in Africa and Asia are therefore expected to have detrimental impacts on the rural poor households' livelihoods indicators, especially on those pertaining to income, food and nutrition security, and gender equality. A review of the literature on economic impacts of transboundary animal diseases reveals that rural poor households suffer greater impact when poultry disease outbreak occurs (FAO, 2002; Otte et. al., 2004; 2006; FAO, 2008). Rural poor are especially vulnerable to HPAI or other poultry disease outbreaks due several reasons. First, rural poor households keep few numbers of birds and the poorest households obtain highest share of their income from poultry (Roland-Holst et. al., 2007). Second, rural poor have limited or no access to infrastructure and inputs (e.g., vaccination, biosecurity, balanced feed) which are necessary for the minimisation of HPAI contamination risk. Third, an outbreak may wipe out the entirety of a rural household's flock, thereby removing their entitlement for compensation. Finally, even though information on HPAI and education/training for biosecure production may be available for some rural poultry producers, poorest segments and women poultry producers may not have access to these.

Most of the HPAI research to date has been epidemiological, focusing on the prevention of the infection both among poultry, and from poultry to other livestock and humans. There have been several economic studies which focused on the impacts of HPAI and other poultry diseases on production losses and hence on income, with little or no attention paid to the impacts of HPAI on livelihoods strategies and outcomes other than income (Hall, 2002; Anderson, 2003; Kinung'hi et. al., 2004; FAO, 2006; Akpabio et al., 2007; Burgos and Burgos, 2007; You and Diao, 2007). Although there have been some theoretical studies (e.g., Beach et al., 2007a; 2007b) limited research efforts have been directed towards investigating the efficient and effective *ex ante* and *ex post* disease control policies/programmes to reduce HPAI risks and to mitigate the impacts of HPAI on affected households. Therefore, there is currently very scant evidence-based research on the impacts of HPAI outbreaks and threats on the livelihoods of rural poor and the cost effective strategies to minimise HPAI risks.

One of the aims of the Pro-Poor HPAI Risk Reduction Strategies project funded is to fill in these gaps by conducting in-depth research on the impacts of the HPAI outbreaks and threats on rural livelihoods, specifically to measure the rural households' vulnerability to this livestock disease and its associated repercussions (e.g., food and nutrition insecurity anddeepened gender inequality). The key rural livelihoods and vulnerability related research questions that will be investigated in this project are:

i. How do HPAI outbreaks and threats affect rural households' assets; livelihood strategies that can be achieved with these assets and the resulting livelihoods outcomes?
ii. To what direction and extent do household assets, livelihood strategies and outcomes change in response to various risk minimisation strategies and changes in disease control policies?

The aim of this paper is to provide a methodological framework that will enable the collection and analysis of primary data to measure the impacts of HPAI on assets, livelihood strategies and the various indicators of rural livelihoods, as described above. To this end, the Sustainable Livelihood Framework (SLF) and complementary qualitative and quantitative methods are proposed to answer these two broad research questions. More specifically, the paper describes how the SLF; a combination of data methodologies and sources can be applied to study the impact of HPAI on rural livelihoods, and to evaluate strategies to minimize HPAI disease risk. Of specific focus in this framework is the identification of those quantitative indicators which can detect and measure the effects of HPAI on livelihoods, and can therefore inform the development of cost effective risk minimization strategies and policies.

The rest of this paper unfolds as follows: The SLF, as the underpinning conceptual framework, is explained in the next section. This is followed by the description of the conceptual framework adopted to study the key research questions; the resulting main hypotheses and review of those studies which tested similar hypotheses. The analytical framework proposed to test these hypotheses and the data requirements are explained in section 4. Section 5 discusses the application of these proposed conceptual and analytical frameworks in selected case study countries.

2. The sustainable livelihoods framework

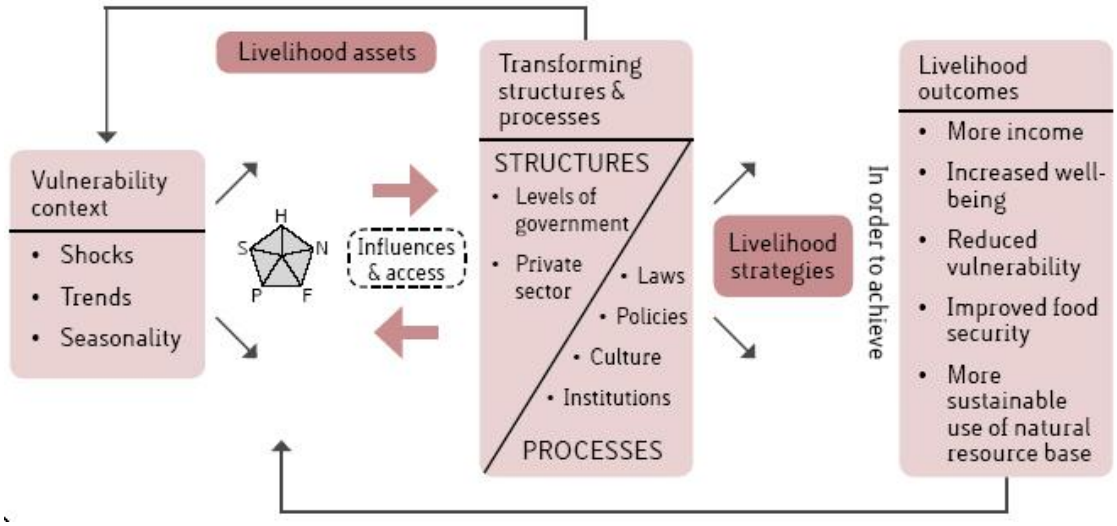
2.1 Description of the sustainable livelihoods framework

Livelihoods research is linked to the 'New Poverty Agenda' of the 1990s, which recognized the deficiencies of a solely income-based measurement of poverty, and adopted a multi-dimensional view of poverty including indicators to measure improvements or shortcomings pertaining to health, education and environment (Prowse, 2008). The livelihood concept is based on the premise that a rural household has access to (or has an endowment of) a minimum amount of resource base (i.e., capital or assets), which can be utilised to fashion out a set of livelihood strategies (e.g., crop farming, livestock rearing, off farm employment, etc.) to improve household welfare (Chambers and Conway, 1992). A household's livelihood is sustainable if it can cope with and recover from shocks (such as civil conflict or emergence of new human, crop or livestock diseases) and stresses (e.g. recurrent adverse weather and seasonality); maintain or enhance its capabilities and assets, while

not undermining the natural resource base (Chambers and Conway, 1992; Scoones, 1998; Ellis, 2000).

The SLF proposed by Chambers and Conway (1992) was expanded by DFID (2000) and became a popular tool within development studies, as well as for development policy and planning (Prowse, 2008). The popularity of this approach stems from the numerous benefits it has brought to development research and policy, such as the opportunity to conduct inter-disciplinary and cross-sectoral analysis, and linking both macro and micro levels (Carney 1999; DFID, 2000; Prowse, 2008). The DFID SLF is presented in Figure 1. As it can be seen the framework consists of four elements: a vulnerability context, an asset pentagon, transforming structures and processes, and livelihood strategies. The framework shows that these four inter-related elements contribute to livelihood outcomes (Ashley and Carney, 1999; Carney et al, 1999; DFID, 2000).

Figure 1. DFID Sustainable Livelihoods Framework



Source: Carney et al. (1999)

According to the SLF presented above, an assessment of the impacts of a shock and/or stress on livelihoods should begin with an analysis of assets i.e., a review of what people have (Carney et al., 1999). Among the assets available to an agricultural household are natural capital (N), physical capital (P), financial capital (F), human capital (H), and social capital (S), though this list is not exhaustive (Scoones, 1998). Not depicted in Figure 1, but also considered as important assets are political capital (Tofique, 2001) and location capital (Jansen et al., 2005). The quantity and quality of these assets and access to hereof are influenced by the vulnerability context, including trends, shocks and stresses. Some examples of shocks are natural disasters, civil wars and HPAI outbreaks, whereas trends are expected disturbances such as hungry seasons and endemic livestock or human diseases. The SLF depicts a set of transforming structures and processes, such as policies and institutions, which influence livelihood strategies. Based on the various interactions livelihood between assets and transforming structures and processes, the SLF delineates a set of livelihood outcomes, which could be a combination or one of these: more income; reduced vulnerability to trends, seasonality, shocks and threats; improved food security; reduced malnutrition and a more sustainable use of the

natural resource base. Households are viewed as being sustainable if they can cope with trends, shocks and seasonality without compromising their future ability to survive these.

In addition to the DFID SLF, there are a number of SLFs that also take an asset-based and vulnerability approach to the analysis of rural livelihoods. These are CARE, Oxfam and UNDP livelihoods approaches, all of which are based on the livelihoods definition of Chambers and Conway (1992). Similarly to the DFID SLF, all of these SLFs stress the need to understand micro and macro (and policy) links. All of these SLFs identify the contexts, conditions and trends within which a rural household combines its assets to generate bundles of livelihood strategies. These frameworks indicate that the policy context of a rural economy; the trend of socio-economic factors (such as population and macro-economic conditions) and other exogenous factors (such as agro-ecological conditions) determine the type of assets available to the rural households. These SFLs however differ in a few aspects, such as the definition of assets and analysis procedures (Carney et al., 1999). A comparison of the main SLFs is presented in Appendix 1.

2.2 Adaptation of the sustainable livelihoods framework to HPAI shocks and threats

The Pro-Poor HPAI Risk Reduction Strategies Project focuses specifically on those rural poor households that are engaged in the production of poultry, either as one of the several livelihoods strategies (i.e., village extensive/backyard extensive poultry keepers) or as the main livelihoods strategy (i.e., backyard intensive or small scale (semi) commercial poultry producers/farmers). Hence, adaptation of the SLF to this context requires re-definition of the assets that are available to these households and the asset-modifying factors (i.e., transforming structures and processes depicted in Figure 1).

At a household scale, a poultry-producing household (depending on the agro-ecology of the environment) is expected to have natural capital (land: inherited or acquired; water: stream, borehole, treated water; soil: quality and fertility; genetic resources in the form of disease resistant breed of chicken, etc), physical capital (numbers and types of livestock, production equipment and technologies, basic infrastructure (e.g. building), machinery, transportation), social capital (social networks, social relations, membership of national or village level poultry associations, etc), human capital (number of household members, their gender and age compositions, skills, knowledge (indigenous/local or formal through extension training), (in)formal education, good health, ability to work, household size and demographics), and financial capital (cash, credit/debit, savings).

In addition to these traditional definitions of capital, there are other capital/assets such as information, location and political capital, which might have impacts on the livelihood strategies and resultant outcomes. Information capital might include the type, amount and source of information a poultry-producing household has about biosecurity, HPAI or other poultry disease risks and disease prevention This capital would determine households' ability to manage poultry health and have impacts on their attitudes towards risk. Location capital constitute all location specific factors, such as access to infrastructure (e.g., roads) and markets (Jansen et al., 2005), as well as being located in areas where HPAI risks could be higher (e.g., near wetlands or borders where there might be some illegal trade of poultry and poultry products). Political capital describes farmers' social standing with the administrators (such as the local government council, political office holders, local elites and head of a community, to name a few) which might have implications on farmers' access to public

sector interventions regarding disease control (e.g., subsidized inputs such as drugs, disease-resistant breeds, vaccinations, funds (e.g., subsidies or credit) for biosecurity investment or compensation in case flocks are culled) (Tofique, 2001).

Together these assets constitute a stock of resources used to generate well-being (Moser, 1998; Rakodi, 1999). The productivity of these assets, and hence their contribution to the overall livelihood outcomes often depends on their complementarity. In the case of poultry assets, for example, poultry may have different implications on livelihood outcomes depending on the distance to the live bird markets and/or access to transportation as well as means of transportation. Furthermore the institutional context (e.g., political, regulatory and legal frameworks), in which households operate affect management and productivity of assets and the type and success of livelihood strategies undertaken. For example, strict disease control policies (e.g., those ensuring high levels of biosecurity) could render village level poultry keeping an obsolete livelihoods strategy, but if government subsidies and training and extension programmes are available, households could invest in biosecure backyard poultry production. A household's management of its asset portfolio constitutes household behaviour or livelihoods strategies, which refer to the ways the household combines its assets to generate well being (Jansen et al., 2005). For example, households may combine their poultry assets with their knowledge of healthy poultry management to produce safe and nutritious poultry meat and eggs which may result in livelihoods outcomes of improved household nutrition or when combined with market infrastructure and transportation assets, these could result in the livelihoods outcome of poultry income.

The SLF framework will enable understanding of the impact of the vulnerability context, which in this case is HPAI shocks and threats, on the other three components of the framework:

i. Livelihood assets: Changes in a household's asset portfolio, including, for example, changes in poultry assets (in quantity and value); changes in human capital in the form of information and education pertaining to poultry production; changes in poultry infrastructure (e.g., coops) to improve biosecurity.
ii. Transforming structures and processes: Changes in institutions, such as policies for disease control, surveillance, and changes in markets (e.g., demand, prices etc.).
iii. Livelihood strategies: Ex post HPAI coping strategies, such as substituting poultry meat and eggs for other less nutritious foodstuff (e.g., vegetables), and ex ante and ex post risk management strategies, such as diversifying into other livelihoods strategies, such as crop farming or other small livestock rearing.

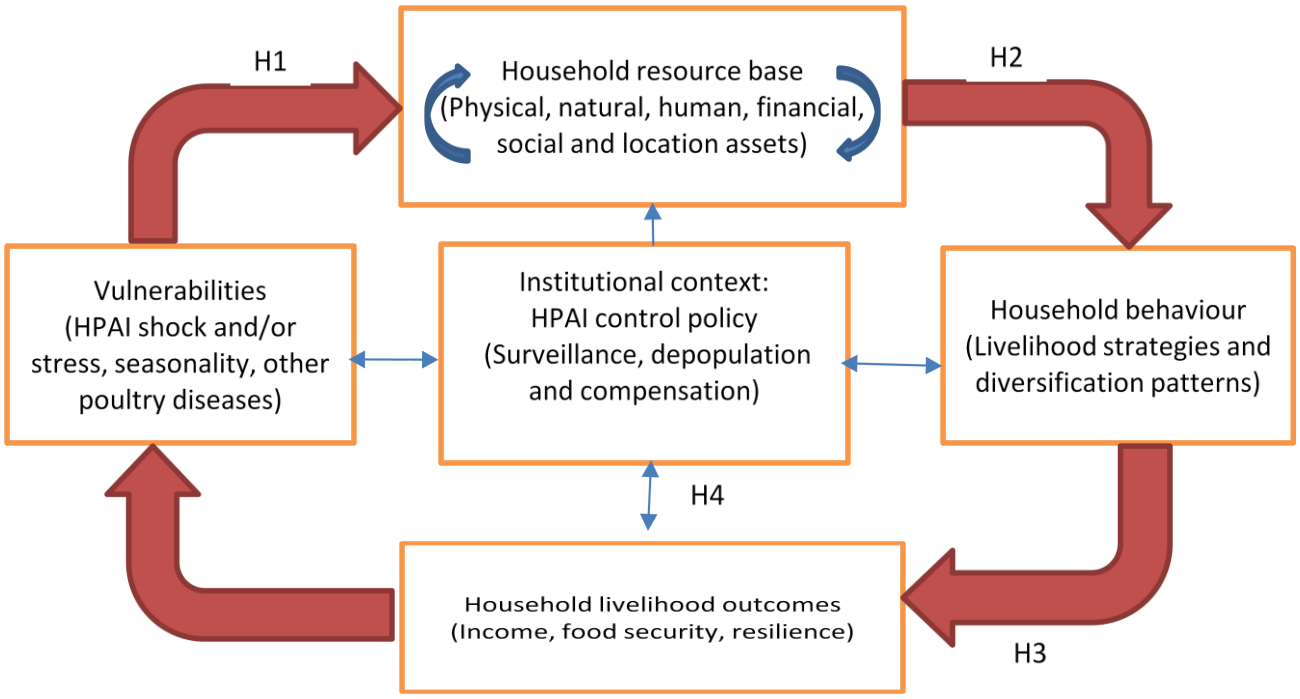
Impacts of HPAI on all of these components of livelihoods are expected to affect various livelihoods outcomes including poultry income, wealth (savings/insurance), food and nutrition security, and gender equality. The interrelationships between these three components of the SLF in the context of HPAI shocks and threats and the impacts on livelihoods outcomes are explained in greater detail below, where the resultant hypotheses are also stated.

3. A conceptual framework for investigating the impacts of HPAI shock and stress

The aim of this paper is to develop a framework to assess the livelihood impacts of HPAI outbreaks (shocks) and threats (stresses) and disease control strategies and policies on household livelihoods indicators. To this end based on the previous work by Reardon and Vosti (1995), Orr and Mwale (2001), Jansen et al. (2005), Sesabo and Tol (2005), Iiyama (2006) and Roland-Holst et al. (2007), the basic SLF presented above is augmented to conceptualise the analysis of household response to HPAI outbreaks and threats.

As explained in the generic SLF above, vulnerability contexts, such as the HPAI shocks and stresses affect household's livelihoods asset portfolio, which includes physical capital such as the poultry asset base. The impact of HPAI on poultry asset base in turn brings about coping strategies and mechanisms, which have implications for household behaviour or livelihood strategies (mainly those pertaining to poultry keeping/production) and hence on the overall household livelihood outcomes (income, food and nutrition security). Household livelihood outcomes in turn determine the level of future vulnerability of the households to various shocks and stresses, including future outbreaks/threats of HPAI. Transforming structures and processes, i.e., the institutional context, which in this case comprises policies pertaining to the control and management of HPAI (surveillance, depopulation, compensation, biosecurity laws etc), are influenced by the vulnerability context, i.e., HPAI disease situation, household livelihood strategies (e.g., poultry management, level of biosecurity), as well as household outcomes (e.g., income from poultry). At the same time, institutional context has implications on the extent and impact of HPAI outbreaks and threats on household asset base, household livelihood strategies and outcomes. These relationships are illustrated in Figure 2.

Figure 2. Conceptual framework for investigating the impacts of HPAI shock & stress



This simple conceptual framework introduced in Figure 2 results in four key hypotheses to be explored in this project:

H_1: HPAI shocks and stresses result in the loss of poultry assets and the extent of this loss depends on various household and community level as well as institutional factors.

HPAI outbreaks result in the loss of poultry either in volume (due to disease contamination and/or depopulation/culling) and/or in value, i.e., in the price (due to decreases in consumer demand as a result of outbreaks and/or scares). Similarly, even if an HPAI outbreak may not affect the flock owned by a household, it may have detrimental impacts on the overall value of household's poultry assets. The magnitude and direction of the HPAI outbreak and/or threat on poultry asset value and/or volume are expected to be context specific, depending on various factors such as distance to the outbreak epicentre or live bird markets; the nature and efficacy of disease control policies; availability of substitute commodities/assets; efficiency, efficacy and reliability of risk communication, to name a few.

Almost all of the previous studies on the analysis of the impacts of shocks and stresses on rural livelihoods start by making an inventory of the assets the households have. Knowledge on type, quantity and quality of various asset types enables understanding of the complementarities and substitutions between each asset type and how they determine household livelihood strategies, as well as households' choices of coping strategies (see e.g, Jansen et. al., 2005). Therefore detailed data on each asset type owned by the household should be recorded in the household surveys purposefully developed to study the impacts of HPAI on rural livelihoods.

Even though all of the assets described in section two are crucial for the formation of livelihood strategies and coping mechanisms against HPAI shocks and threats, specific attention should be paid to some of them. Detailed information on the number, type (species), variety and market prices, as well as flock dynamics of poultry should be collected. In the rural livelihoods context poultry may count as natural capital (especially for the genetic resources present in rural poultry varieties) (Campbell et al., 2002), as well as physical capital (as a part of the productive assets, for example to provide meat and eggs for market sales and/or to meet the nutritional needs of household human capital). Moreover, similarly to other livestock, poultry is often considered as a major insurance asset, which households usually liquidate during short-term crisis (e.g. Campbell and Trechter, 1982). It is therefore important to verify for what purpose(s) rural households keep poultry so as to understand the impacts of HPAI induced loss in value and/or volume of poultry on household livelihoods strategies and their vulnerability to future shocks and threats.

Other assets that are thought to be important complements to poultry are human capital, location, social and political assets. Information should be collected on the gender and age composition of the household members, as well as on their education, training and experience, especially with regards to livestock in general and poultry in particular. Information on the ownership and management of poultry disaggregated by gender would shed light onto the gender issues in village poultry production system (Kitalyi, 1998; Guèye, 2005; Muchadeyi et. al., 2005) and will enable determination of the impact of HPAI on household livelihoods as well as on women's livelihoods. Moreover, data on the household size and demographics (especially dependency ratio) would provide information on the protein and micronutrient consumption patterns in households. In addition, information on the current level of experience and education household members have,

could be used to test if these assets can explain diversified livelihood patterns as found by previous studies (Iiyama, 2006). Finally, information on poultry specific experience and education could help inform training interventions for biosecure poultry management.

Information on other household (and community) specific assets such as location capital (e.g. access to infrastructure and public services, access to markets, remoteness, proximity to wetlands and border); social capital (village tradition, culture, religion), political capital (relationships with the local governments, NGOs) should also be collected. All of these assets are expected to have impacts not only on poultry management, but also on livelihoods strategies and coping strategies (Pyle, 1992; Jansen et. al, 2005; Gilbert et. al., 2007) in the case of HPAI shocks and stresses.

Finally information on other assets such as land, machinery, and other livestock should also be collected to be able to understand the various livelihoods strategies that might be available to the households before and after HPAI induced shocks and stresses.

H_2: Poultry asset loss results in changes in the household behaviour/ livelihood strategies.

Changes in the household behaviour or livelihoods strategies are classified into two categories: *ex post coping* decisions, following an outbreak, and *ex ante* or *ex post* risk management decisions pertaining to disease threats. *Ex post* coping decisions are short term asset (dis)investments which may include segregation of species, rapid selling off of poultry or reduction in the consumption of poultry meat and eggs, whereas risk management decisions constitute longer term asset (dis)investments, such as investment in biosecurity, training in biosecure poultry production, diversifying into other agricultural activities (e.g., crop production, other livestock rearing), or migration to name a few. Coping and risk management decisions are expected to be affected by several household specific characteristics (e.g., household asset portfolio, and in particular household's risk perceptions), as well as the institutional context such as the disease control policy (e.g., surveillance in live bird markets, compensation schemes, biosecurity requirements) and other public interventions (e.g., subsidies for strengthening of biosecurity, extension services of training in biosecure poultry production or other alternative livelihoods activities), as well as private sector services such as availability of credit.

Several studies to date have used the SLF or a similar asset-based approach to investigate *ex-post* coping and risk management strategies to shocks and *ex-ante* risk management strategies to stresses. The nature of coping mechanisms adopted and their returns have been recognised as important channels for tracing the livelihood impacts of various types of stresses and shocks, such as drought, famine, civil war, macro-economic policy change as well as household level stressed and shocks such as illness, death, divorce and indebtedness, to name a few (e.g. Campbell and Trechter, 1982; Watt, 1983; Cutler, 1984; 1986; de Waal and El Amin, 1986; Corbett, 1988; Pyle, 1992; Adams, et al., 1998; de Waal, 2004; Orr and Mwale, 2001; Barret et. al., 2001; Brockington, 2001; McPeak, 2004; Mishra, 2007; Roland-Holst et. al., 2008; Smucker and Wisner, 2008). These studies on coping mechanisms found that the initial asset endowment have the greatest impact on the coping strategies, with poor asset endowments resulting in low–return coping strategies and exposing poor households to increased vulnerability to shocks.

Moreover, the role of livelihood diversification as a risk management strategy (e.g., against droughts, loss of various necessary inputs such as land and water) as well as a *ex post* coping strategy has been

investigated by various studies (e.g., Reardon et al., 1992; Rosenzweig and Binswanger, 1993; Reardon, 1997; Reardon et al., 1998; Ellis, 1998; 2000; Kingsey et al., 1998; Brockington, 2001; Ersado, 2003; Jansen et. al., 2005; Adriansen, 2006), many of which have also estimated the impact of diversification on livelihoods outcomes. Overall these studies have shown that rural poor do not specialise in one activity only, i.e. they diversify their livelihoods strategies, and the more diverse are the livelihoods systems, the less vulnerable they are to shocks and threats and the higher the livelihoods outcomes they yield (Ellis, 2000; Iiyama, 2006).

In those countries where HPAI outbreaks have occurred, an assessment of the impacts of HPAI outbreaks, i.e., shocks, on the livelihoods outcomes of the rural poor should focus on the investigation of the nature and extent of *ex post* coping strategies. To this end, both qualitative and quantitative household, community, regional and national level data should be collected on the exact sequence of the events resulting in the shock; resulting market conditions; asset endowments and livelihoods strategy portfolios prior to and following the shock (Corbett, 1988). Similar data, as well as information on the households' and communities' knowledge of HPAI and risk perceptions and attitudes should be collected to investigate the impact of HPAI threat, i.e., stress on household *ex ante* risk management behaviour.

H_3: Changes in household livelihood strategies result in changes in livelihood outcomes.

HPAI outbreaks and threats are expected to have significant and negative short run and long run impacts on several measurable household livelihood outcomes of poultry producing households, such as household income from poultry, food and nutrition security, and gender equality, as explained in the introduction. The long run impacts of HPAI, however, could also be positive, if households improve/ invest in their poultry management practices (e.g., biosecurity levels, feed and other factors that affect poultry immune systems) as a result of increasing awareness and/or due to compensation and/or other public sector schemes. The net long run impact of HPAI on household livelihoods outcomes could be either positive or negative depending on various factors, such as household specific characteristics (e.g., household assets), as well as the institutional context, such as the compensation schemes and/or availability of retraining in alternative livelihoods activities.

Those studies which have investigated the impact of coping strategies on household livelihoods outcomes and impacts of unfavourable/insufficient livelihoods outcomes on coping strategies, have generally focused on food security as the livelihoods indicator. Households were found to respond to food insecurity caused by shocks and stresses through adoption of various coping mechanisms, including reduction in quantity, composition and quality of foods consumed; collection of wild foods; reduction in daily meal frequency; borrowing from relatives, and inter-household food transfer, to name a few (Cutler, 1986; Corbett, 1988; Neumann et. al., 1989; Dirorimwe, 1998; Paul, 1998; Ogden, 2000; Mishra, 2007; Smucker and Wisner, 2008). Other studies have investigated the direct relationships between assets endowments and food security outcomes (e.g., Agbola et. al., 2004).

A great majority of those studies that have investigated the impacts of livelihood diversification on livelihood outcomes on the other hand have focused on per capita income or consumption as the main livelihoods indicator (e.g., Ersado, 2003; Jansen et. al., 2005). Several livelihoods diversification studies have found that the per capita incomes or consumption of households with more diverse livelihood strategies were less vulnerable to various shocks and stresses (see e.g., Ellis 2000; Iiyama, 2006). Therefore several researchers have argued that effective policies for poverty reduction would

constitute those that encourage the diversification of livelihoods into various off farm and on farm activities (see e.g. Reardon, 1997; Davies and Hossain, 1998; Phillipson et al., 2004). In fact, in the context of HPAI, Roland-Holst et al. (2008) have shown that policies based on livelihood diversification helps smallholders secure their future livelihood by sustaining their 'long-term risk management capacity' unlike a compensation scheme which creates negative coping strategies such as 'disease concealment' or sale of infected poultry. Therefore the necessary institutions and incentives (such as subsidies, credit etc) should be provided to allow for rural households to diversify into various livelihoods activities.

In order to investigate the impacts of HPAI on livelihoods strategies and outcomes, it is imperative to collect information on the various livelihood strategies rural households undertake and returns to each strategy, both before and after outbreaks; as well as the coping strategies they have adopted since the outbreaks and how these have changed their livelihoods outcomes.

H_4: HPAI control policy affects household livelihood outcomes and household livelihood outcomes determine the efficacy of disease control policy.

Household livelihoods' rate of recovery from and/or resilience to HPAI outbreaks and threats depend on the efficacy and efficiency of the disease control policies. These policies include, but not limited to the following: timing and amount of compensation; extension services/technical advice regarding poultry management in general and biosecurity measures in particular; subsidies to enable adoption of biosecurity measures, as well as availability of micro-credit to accumulate those assets necessary for more productive poultry production or participation in alternative livelihood strategies. Furthermore, the success of disease control policy also depends on the livelihood outcomes (e.g., dependence on poultry for the overall household income, for food and nutrition security and gender equality), as well as household characteristics (e.g., risk perceptions and available assets which influence coping and risk management decisions) in addition to other policies (e.g., subsidies for crop production) and formal or informal institutions (e.g., banishment from the community or fines for non-reporting).

Several livelihoods studies have investigated the impact of institutions and policies (such as food for work projects, currency devaluation, fluctuations in global commodity prices) on rural livelihoods (see e.g., Barret et al., 2001; Eakin et al., 2006). An overall review of the livelihoods studies reveal that while shocks and stresses such as natural disasters, droughts, and diseases are usually have negative impacts on the livelihood outcomes, impacts of policy and institutional changes on livelihoods outcomes could be either negative or positive. There are also a few studies that have investigated theoretically the efficacy of HPAI control policy, especially the effectiveness of compensation schemes (e.g., Hennessy, 2005; Gramig et. al., 2005; Beach et. al., 2007b). These studies have shown that compensation schemes may create disincentives for reporting and/or for investment in biosecurity. Other policies, including subsidizing private disease control measures and distribution of animal health information and education via agricultural extension or the media may provide incentives for more disease control, especially for smaller farms. Some authors (e.g. Otte et. al., 2006, Roland-Holst et. al., 2007) have also argued that compensation for HPAI outbreaks is an inappropriate intervention because it results in emergence of negative coping strategies (e.g. consumption and sale of infected birds, as explained above). Beach et al. (2007b) have further argued that making compensation depend on the level of biosecurity investment at least partially mitigates

the disincentives generated by the compensation schemes, and other policies, such as subsidizing private disease control measures and distribution of animal health information and education via agricultural extension or the media may provide incentives for more disease control, especially for smaller farms.

In order to understand the relationship between livelihoods outcomes at the household levels and the HPAI control policies, information on the current disease control policies and prevailing formal and informal institutions should be collected. Qualitative and quantitative information on poultry producers' reactions to/perceptions of policies and institutions, as well as information on how these policies and institutions have evolved/are evolving, would also help explain the efficacy of these policies and institutions in HPAI control, as well as their impacts on livelihoods outcomes.

The next section proposes inter-disciplinary and analytical methods, and as well as types of data, which could be used to test the four hypotheses introduced above.

4. Analytical framework and data requirements

The discussions of the hypotheses presented above suggest the need for an inter-disciplinary approach and several data types and sources. Implementation of a comprehensive livelihoods approach requires multiple analytical techniques and data sets, each of which informs the others (DFID, 2000; Jansen et al., 2005; Prowse, 2008). In order to study the impacts of HPAI on rural livelihoods methodological pluralism is proposed. Methodological pluralism refers to the use of both qualitative and quantitative methods adopted from various social sciences, as well as the use of methods and data adopted from other disciplines. Use of a pluralistic methodological framework in the study of livelihoods has long been advocated (see e.g., Carvalho and White, 1997), and is an emerging trend in development studies literature (see, White, 2002; Jansen et al, 2005; 2006; Kanji et al., 2005; Addison et al., 2008; Prowse, 2008; White 2008). It has been argued that for livelihoods research to be successful, and for it to be effectively linked to policy, it must include a sequence and combination of quantitative and qualitative research methods (see Murray 2000; 2002). This is because livelihoods analysis is a complex, multi-faceted endeavor and different methods and data are required to tackle different problems, and a combination of techniques and data will frequently yield greater insight than either one used in isolation (White, 2002).

Some of the methods, techniques and data sources that can be used to test the hypotheses introduced above include, but are not limited to the following:

1. Spatial analysis, geo-referenced/geo-coded disease data, GIS overlays, disease risk maps/pathways and secondary data on national level poultry production and consumption (such as the available livestock census or Living Standards Measurement Study (LSMS) surveys) to identify in which rural areas poultry production is an important source of livelihoods and within those, which areas are most/least likely to be affected by HPAI shocks and stresses. Use of geo-coded disease data on the cases, incidence and prevalence of HPAI has already been recommended by Beach et al. (2007a) and the use of spatial analysis methods, GIS overlays and secondary data in the SLF was suggested by Jansen et al (2005). The information generated by these data sources is expected to aid in the testing of H_1,

especially in the identification of those households whose poultry assets and hence poultry related livelihoods would be/have been most affected by HPAI outbreaks and threats. Furthermore this information is expected to aid in the sampling framework required for the implementation of the quantitative and qualitative survey instruments.

2. Quantitative household analysis using structured household surveys and based on farm household models (e.g., Singh et al., 1986; de Janvry et al., 1991) to understand how livelihood strategies are determined given various household assets and contexts, and how much and in what direction the asset base (e.g., number of poultry owned), household behaviour (e.g., investment in biosecurity) and measurable livelihoods outcomes (e.g., poultry/total income, nutrition, food security) are affected by HPAI shocks and stresses. Agricultural household model has been used to model theoretically the influence of the farm level decision making on the spread of HPAI (Beach et al. 2007a) and to analyse the effects of different policies (e.g., compensation, subsidising disease control measures, information and education on HPAI) on farmer decision making. Several other studies have employed the farm household model to estimate the impact of shocks (e.g., market level shocks) on livelihoods indicators (see e.g., Komarek and Ahmadi-Esfahani, 2007 for an application of the farm household model on the estimation of the market shocks on household welfare). The data generated through purposefully developed household surveys will therefore be used to test hypotheses one, two and three, as well as to provide information for the testing of H_4.

3. Qualitative analysis using participatory techniques, such as participatory poverty assessment (PPA) to investigate a variety of issues, some of which cannot be captured in detail with the use of the structured surveys. These include household and/or community level knowledge, attitudes, and risk perceptions regarding HPAI, as well as current biosecurity practices; intra-household dynamics in poultry production, consumption and sales; socio-cultural and religious practices; traditional institutions, as well as past household experience in managing poultry/livestock/crop or human disease related stresses and shocks. PPA can also capture the livelihoods dynamics (changes in assets, strategies and outcomes over time) which may not be captured correctly through the use of recall data collected via cross section household surveys (Addison et al., 2008). Data generated by these approaches will not only inform development of the structured survey instruments and experiments to tests for all four hypotheses, but will also provide valuable information to explain the unquantifiable impacts of HPAI threats and shocks to household assets (H_1) and livelihood outcomes (H_3), and will help us understand the various livelihood strategies undertaken by the households (H_2).

4. Experimental methods, such as behavioural "laboratory experiments in the field" and/or stated preference methods, to understand those disease control policies that would be most acceptable and/or preferred by the households. The most preferred/acceptable disease control policies would constitute those policies that would be most efficient and effective in the control of HPAI. Moreover these experimental methods can help in the identification or profiling of household types/characteristics, which would respond well to different disease control policies, so as to be able to recommend tailor-made policies for different household/producer types. Data collected through these methods will therefore be used to test H_4.

More specifically, the following techniques of analysis can be implemented to test the hypotheses introduced in the previous section:

Approaches to test H_1: In those countries where household level data will be collected (i.e., Nigeria), H_1 can be tested as an artifact of the proposed survey design, which aims to collect data from communities with similar asset base and transforming structures and process, but differ in terms of HPAI situation. Through disease risk maps, timelines and available secondary level data from the Nigerian Living Standards Survey (NLSS), several communities will be selected to include control group communities, i.e., those communities which have not experienced HPAI outbreaks/threats, and two treatment groups, i) communities that experienced HPAI outbreaks/threats recently and ii) communities that have experienced the outbreaks in the past and since then participated in compensation schemes. Propensity score matching (PSM) methods, particularly non-parametric estimation of the propensity scores will enable identification of those communities in control and treatment groups, which are similar to each other in several characteristics (agro-ecology, economic development and income level, households' asset portfolios etc) except HPAI status (Gilligan, 2007). The differences among these communities in terms of the numbers of poultry managed (and/or contribution of poultry to household protein/micro-nutrient consumption) would reveal the impact of the HPAI outbreaks and threats on poultry production/consumption, and the rate of recovery (either due to time span and/or due to compensation). Regression analysis (e.g., a Poisson/negative binomial regression of number of poultry controlling for various household level factors that affect poultry assets (e.g., access to live bird markets, availability of complementary assets)) could also be carried out for each community type and the similarity/differences of community level models can be compared by log likelihood tests.

In some study countries (i.e., Indonesia), already existing *ex post* HPAI outbreak household data will be used (please see Roy and Tiongco, 2008). In order to assess the impact of HPAI on household asset base and livelihood outcomes, counterfactual analysis, i.e., generation of counterfactual distributions of poultry numbers and income will be carried out to simulate the situation before the outbreak. These counterfactual distributions can be obtained by using either parametric or non-parametric methods. The method will include computing the counterfactual distributions assuming no prior outbreaks of HPAI. Comparing these to the actual distributions would indicate the impact of HPAI on assets (number of poultry) and livelihood outcomes (incomes) (see DiNardo et al., 1996).

Approaches to test H_2: Since time series data will not be available for the case study countries, the impact of changes in poultry asset base on household behaviour, that is livelihood strategies and diversification patterns, could be investigated with the use of the qualitative methods (PPA, or focus group discussions). These qualitative methods would allow for the capturing of the dynamic changes in livelihood strategies. In the case of purposeful sampling as explained above, the differences between the knowledge attitude, perceptions and practices (KAP) of those households who had suffered HPAI outbreaks/threats and those who have not could be statistically tested. Furthermore, regression analysis, such as ordered probit, could be used to test this hypothesis, by regressing the level of biosecurity practice as a function of subjective and objective risk measures, household characteristics (asset base), and importance of poultry as a livelihoods strategy (in the case of possible endogeneity instrumental variables (IV) estimation can be used).

In addition to the collection of qualitative data as a part of the purposefully developed survey instruments, recall data could also be collected on the households' pre-HPAI outbreak poultry management practices, number of poultry owned, bought, sold, prices and contribution of poultry to household income and nutrition and food security. Even though recall data are generally subject to measurement errors, especially in the context of high variability, such as common in the agricultural sector (e.g., Maruyama, 2007), having post and pre-outbreak data on these variables would enable analysis of the data in a panel data format. Furthermore, since some of these variables are available from the secondary data collected prior to the HPAI outbreaks (e.g., the latest NLSS collected in 2004), reliability of recall data could be tested against the actual data collected in 2004.

Approaches to test H_3: One means of testing this hypothesis is the technique based on the generation of the counterfactual distributions of livelihood outcomes (i.e., income or poultry consumption) using parametric or non-parametric methods, as explained above. In addition, methodology developed by Jansen et al. (2005) can be used. This methodology is based on the use of the factor analysis method to allocate farmers to the main livelihood strategies and then measurement of the impacts of livelihood strategies as well as HPAI related factors (e.g., risk perceptions, distance to the outbreak epicentres) on livelihood outcomes (income, food consumption). Endoneneity can be accounted for by estimating a two-stage instrumental variables regression, as suggested by Jansen et al. (2005). Similar methodology was used by Ersado (2003) who developed a model that contemporaneously determines income diversification and per capita consumption as a function of explanatory variables such as assets and regional dummies. Since this system is endogenous, similarly to Jansen et al. (2005), Ersado (2003) estimates it by using a two-stage least squares instrumental variables regression.

Approaches to test H_4: In the case of purposefully designed sampling the impacts of policies, such as compensation, on livelihoods outcomes such as income (or income recovery), can be measured by comparing the descriptive statistic of two treatment group communities, i.e., those communities that recently had HPAI with those communities that had HPAI and got compensated. Alternatively, KAP surveys and behavioural experiments (whether hypothetical choice experiments or "laboratory experiments in the field") could be employed to investigate what kind of institutions (e.g. compensation schemes) would be preferred by what kind of households and how households' preferences for different institutional mechanisms are affected by their livelihood outcomes (e.g., income from poultry, total income, food and nutrition security provided by poultry etc). A few studies to date have investigated the compensation schemes for various public policies by the use of the hypothetical choice experiments (see for example Horne and Petäjistö, 2003; Grosjean and Kontoleon, 2008). Hypothetical choice experiments were also used to investigate food consumers' preferences for institutions and policies to control for livestock diseases such as control measures to minimise bovine tuberculosis in cattle (Bennett and Willis, 2007) and food labelling to minimise the food safety risks associated with mad cow disease (Loureiro and Umberger, 2006). Please see Viceisza (2008) for a detailed explanation of the use of field experiments in the study of HPAI prevention and control.

5. Application of the conceptual and analytical frameworks to case study countries and concluding remarks

The aim of this paper was to provide a methodological framework that will enable the collection and analysis of primary data to measure the impacts of HPAI on household assets, livelihood strategies and the various indicators of rural livelihoods, including income, food and nutrition security and gender equality. Among the five study countries of this Project, it is proposed that given the time and budget constraints, the framework, hypotheses and methods explained in this paper should be applied to the two study countries in which HPAI is endemic. These are Indonesia and Nigeria, as alluded to above.

In Nigeria, collection of primary household level data is proposed. Secondary data from the latest Nigerian Living Standards Survey (NLSS 2004), as well as disease risk pathways and available geo-referenced data from the disease risk work package of this Project will be used to conduct the PSM exercise for the selection of the control and treatment communities with differing HPAI status. We propose to implement these surveys across the four main agro-ecological zones of the country, so as to be able to present nationally representative policy prescriptions. Collection of household level quantitative structured survey data; household and community level qualitative data (PPA), as well as a possible choice experiment and/or "laboratory experiments in the field" are proposed to be able to test for the four hypotheses described above.

In Indonesia household level data available from the World Bank will be used to test the hypotheses introduced in section 3. This is a rich data set which contains information on assets, livelihood strategies, livelihood outcomes (in the form of total household income, as well as the role of poultry production therein); knowledge, attitudes and perceptions (KAP) regarding HPAI disease and disease risk; stated preference (contingent valuation) study designed to identify the optimal level of compensation payment (which could be estimated conditional on the household asset base, KAP, diversification of other livelihood strategies etc.). The results of these quantitative analyses will be supported by the qualitative livelihoods data that will be collected in Indonesia through the DFID project.

If time and budget constraints permit, the framework presented in this paper could also be applied in collection and analysis of primary data from Ghana, where three HPAI outbreaks took place in 2007 (see Aning et al., 2008). Even if such primary data cannot be collected from Ghana, qualitative and quantitative data which will be collected through cost benefit and value chain analyses may help test some of the hypotheses identified above. If it is possible to collect primary data in those study countries where HPAI outbreaks have not yet occurred, i.e., in Kenya and Ethiopia, we could either focus on i) the impacts of HPAI scares that took place in these countries due to false alarms as in the case of Ethiopia (Alemu et al., 2008) and outbreaks in neighbouring countries as in the case of Kenya (Omiti and Okuthe, 2008); or ii) those areas with high HPAI outbreak risks (high poultry population, close to wetlands, close to border with countries that have experienced outbreaks etc) where potential impacts on livelihoods may be simulated, or iii) the impacts of other poultry diseases on rural livelihoods, such as Infectious Bursal Disease, Marek's Disease, Newcastle Disease and coccidiosis, which common in Ethiopia and Kenya (Njue et al., 2002; Lobago et al., 2005; Zeleke et al., 2005).

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Appendix Table 1: Comparison of main sustainable livelihood approaches: Uses and operational issues

	CARE	DFID	Oxfam	UNDP
Current uses	Relief through development; Used in urban & rural settings.	Started as a rural tool, now also used to study urban livelihoods; Various uses through development project cycle	Used across development, emergency and advocacy studies, mostly in rural context. Also used for strategic planning purposes, although seldom at the field level.	Used both for rural and urban studies; Used for country programme planning; Also used to study small and micro enterprise activity
Types of activity	Livelihood protection; Livelihood promotion, and Livelihood provisioning.	Various activities to meet international development targets, including poverty elimination. Efforts to link to rights and sector approach.	Strategic planning activities.	Conceptual and programming framework.
Strengths emphasized	Comprehensive yet flexible; Improves sectoral coordination; Increases multiplier effects	Builds upon existing experience and lessons; Offers a practical way forward in a complex environment	Participatory analysis; Enables links to social and human rights approaches.	Links micro-macro; Integrates poverty, environment & governance issues; Gets the most out of communities and donors.
Core ideas/ organizing principles	Household livelihood security People-centred	People-centred Multilevel partnership Various types of sustainability Dynamic Poverty-focused	People-centred Multilevel partnership Various types of sustainability Dynamic	Adaptive strategies Conditioning factors (shocks and stresses that affect asset use)
Starting point	Possession of human capabilities; Access to tangible and intangible assets; Existence of economic activities. Basic needs addressed: - income/employment,	Access to assets; Transforming structures and processes.	Enhancing people's capabilities. Working towards equity. Working towards sustainability; Ensuring links between policy	Programming strategy; Analysis of strengths; Analysis of assets and coping/adaptive strategies.

	- food security, - water supply, - basic education, - basic health and family planning and - community participation.		changes and livelihood improvement.	
Analysis procedures	Identify potential geographic area; Identify vulnerable groups and livelihood constraints; Collect baseline data and identify indicators ; Select communities (taking into account similarity and absorptive capacity).	Social/poverty analysis; Livelihoods analysis using a multitude of tools; Partnership and multi-disciplinary analysis .	Stress on impact monitoring and assessment; Participation of various stakeholders with positive bias towards excluded groups.	Participatory assessment of risks, assets, indigenous knowledge and coping/adaptive strategies; Assessment of micro, macro and sectoral policies; Assessment of potential contribution of modern science; Assessment of existing investment opportunities; Ensuring that the first four steps are integrated in real time.
Understanding of sustainability	Partnerships, institution/ capacity-building; Environmental; Social/gender equity; Emphasis on secure rather than sustainable.	Social, Economic, Environmental, Institutional.	Social, Economic, Environmental, Institutional.	Ability to cope with stresses and shocks; Economic efficiency; Ecological integrity; Social equity.
Asset categories	Human, Social, Economic.	Human, Social, Natural, Physical, Financial.	Human, Social, Natural, Physical, Financial.	Human, Social, Natural, Physical, Economic, Sometimes political.
Distinguishing features of agency's approach	Distinguishes between private natural assets and common property assets; Stress on household level; Personal and social empowerment emphasized.	Stress on underlying principles and a variety of SL approaches; Analysis of strengths; Micro-macro links.	Relatively loosely applied idea across a decentralized organization.	Starts with a strengths (rather than needs) assessment; Emphasis on technology; Emphasis on micro-macro links; Adaptive strategies as the entry point.

Source: Summarized from Carney et al. (1999)