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Rural livelihood adoption framework: A conceptual and analytical framework for studying adoption of new activities by small farmers

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ABSTRACT

The adoption of new income generating activities is a critical livelihood diversification strategy for many small farming households in developing countries. However, innovation adoption in a rural context typically involves complex processes and complicating factors, and rates of discontinuation can be high, with consequent wastage of public and private resources. This paper describes (1) the development of a new conceptual framework with which to analyse the complexity of adoption of new livelihood strategies, and then (2) describes its application in a case study involving mushroom cultivation by smallholder farmers in Vietnam. The new conceptual framework, termed Rural Livelihood Adoption Framework (RLAF), is based on a combination of DFID's Sustainable Livelihoods Framework, Ellis' Rural Livelihood Framework and Rogers' Diffusion of Innovations theory, to capture multi-dimensional factors including livelihood assets, innovation attributes, livelihood outcomes, livelihood systems, vulnerability, and policy and institutional contexts. The application of RLAF to the selected case study of adoption of mushroom cultivation in rural Vietnam enabled systematic and comprehensive description of the livelihood trajectories of the innovation adopters, and identification of critical factors and ways in which those factors influenced adoption behaviours at each stage. It also provided the basis for developing strategies to overcome sustained adoption constraints and barriers. The RLAF is thus an analytical tool with considerable utility for identification of systemic problems impacting on rural livelihoods in developing countries, and for devising effective and relevant solutions.

KEYWORDS: innovation adoption; rural livelihood; livelihood diversification; mushroom cultivation

1. Introduction

Although causes and consequences of livelihood diversification are differentiated in practice by location, assets, income, opportunity and social relations (Ellis, 1998), it has been long recognized as an efficient risk management mechanism to spread risks, and/or earn additional income to supplement that from the main agricultural activities, and thus sustain livelihoods in a risk-prone and uncertain world (Misha *et al*., 2004; McNamara and Weiss, 2005; Hussein and Nelson, 1998). On-farm diversification appears particularly to suit poor rural producers as it helps restructure their production mix more easily than investment in non-farm businesses (Hussein and Nelson, 1998), as well as enhance efficiency of the use of the existing livelihood assets such as natural resources, labour, and skills (Misha *et al*., 2004).

The process of diversifying livelihood activities for the individual farmer is to identify, learn about, implement, adopt and ultimately integrate new income generating activities or innovations into the existing livelihood system. Schipmann and Qaim (2010) argue that innovation adoption can be an important avenue for smallholder farmers to improve their situations. At the macro-scale, innovations, particularly those involving sustainable technologies, are believed to be able to contribute to achievement of regional and national sustainable development goals (Guerin, 2001). Therefore, innovation adoption in agriculture has attracted significant attention among governments, development agencies and their agents, scientists, practitioners, and the public.

In studies of agricultural innovation adoption processes, identifying enabling factors and reducing constraints to adoption has become a priority (Doss, 2006). Research aimed at identifying those factors needs to be based on an understanding of the adoption experiences of adopters, from their first exposure to the innovation,

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through persuading themselves to trial it, followed by a confirming decision to continue or discontinue after a period of implementation. This five-stage innovation adoption process (Rogers 1983) has been widely acknowledged in the literature as effectively describing the innovation adoption process (Feder *et al.*, 1985; Frank, 1995a; Frank, 1995b; Girsang, 2005; Moreland, 2011).

We are especially interested in learning how rural communities in the developing world diversify livelihoods by adopting new activities into their farming system(s). To do this, we developed a conceptual framework in a study designed to explore, in one district of Vietnam, the experiences of subsistence farmers who attempted to adopt mushroom culture into their farming system. The conceptual framework we developed - Rural Livelihood Adoption Framework (RLAF) - integrates several widely accepted research concepts: the Sustainable Livelihoods Framework (DFID, 1999); the Rural Livelihood Framework (Ellis, 2000); and the Innovation Adoption Process (Rogers, 1983).

There are two aims for this paper. The first is to develop the RLAF, and the second is to use the adoption of mushroom cultivation as a case-study with which to critique the utility of RLAF. We explore its capability in enabling systematic and full description of the livelihood trajectories of the innovation adopters, understanding critical factors influencing adoption behaviours at each stage of the adoption process, and then identifying constraints and adopters' strategies to overcome them. Through a combination of different methods including deep interviews and household surveys, the research methodology combines qualitative and quantitative approaches to describing, analysing and evaluating the adoption experiences of respondents.

The remainder of this paper consists of five main sections and a conclusion. First, we briefly review selected literature on rural livelihood study frameworks (Section 2) and on innovation adoption theory (Section 3). In Section 4 we present the conceptualization of RLAF, and in Section 5 the application of RLAF will be illustrated via the case study on the mushroom cultivation adopters in Giao Thuy district, Nam Dinh province, Vietnam. The utility of RLAF is discussed in Section 6, with concluding comments in Section 7.

2. Frameworks for rural livelihood study

The contemporary origin of livelihoods research is the Sustainable Livelihoods Framework (SLF) advocated by the Department for International Development of the U.K (DFID, 1999). The framework defines five components of livelihood assets: human (H), natural (N), financial (F), physical (P) and social (S). The capacity of people to pursue a livelihood strategy, and the success or otherwise of those strategies, is affected not only by their access to these assets, but also by different aspects of their vulnerability, which is largely a function of social, political and economic structures and processes (DFID, 1999; Prowse, 2010). SLF does not prescribe the exact methods to be used for research (Tang *et al.*, 2013), but it could be seen as a set of principles, an analytical framework and an objective (Small, 2007; Morse *et al.*, 2009). However, operationalizing the entire SLF appeared to become an overwhelming task for practitioners to complete (Morse *et al.*, 2009; Prowse, 2010), such that 'livelihoods analysis became an end in itself, without contributing to evidence-based policy' (Prowse, 2010, p. 220).

In an attempt to overcome shortcomings of SLF, Ellis (2000) developed the Rural Livelihood Framework (RLF), which has been demonstrated as being flexible enough to be applied at all scales, from micro, meso to macro (Murray, 2002; Prowse, 2010). More importantly, RLF is more suitable than SLF when studying how poor households in low-income countries combine activities and straddle spaces (Prowse, 2010). RLF also starts with the five livelihood assets accessible by individuals or households, operating within a context of multiple vulnerabilities, to achieve their livelihood strategies through the mediating processes of social relations, institutions, and organizations (Ellis, 2000).

Both frameworks use the same core components of assets, livelihood activities or strategies, outcomes, vulnerability context, and policy and institutional context. However, what is missing from both these frameworks is specific attention to the process of livelihood strategy selection, incorporation and review. For insights into this process we turn to the literature on adoption of innovations.

3. Innovation adoption for rural households

To adopt an innovation, the unit of adoption (individual, household or organisation) will go through a multi-stage process over time (Frank, 1995b; Moreland, 2011) from knowledge, persuasion, decision, implementation, to confirmation (Rogers, 1983; Rogers, 1995). Recent scholars may consolidate these five stages into two phases of initiation and implementation, but they still clearly reflect the stages that Rogers describes (Moreland, 2011).

The adoption process begins when a unit of adoption is exposed to a new idea and gains some understanding about it. Based on the obtained knowledge, the potential adopter will form a favourable or unfavourable attitude toward the innovation at the persuasion stage. Subsequently, there will be engagement in activities to make a decision to adopt or reject that innovation. Implementation occurs when the innovation is put in practice. Ultimately, results from the implementation and other sources of information will help either to reinforce or to reverse the previous decision (Rogers, 1983; Rogers, 1995).

It is important to note that adoption is a complex process (Guerin, 2001), whose outcomes at each stage cannot be certain due to various factors. Some of the key explanatory factors affecting adoption of agricultural innovations, with particular reference to developing countries, have been comprehensively analysed and found to include: farm size, tenure, human assets or capital (such as education, age, labour availability, gender, and farmers' innovative attitudes, goals and behaviours), alternative income sources, credit constraints, supply constraints, information accessibility, infrastructure conditions, risk and uncertainty, extension service, price changes and exposure year (Carletto *et al.*, 2010; Schipmann and Qaim, 2010; Willock *et al.*, 1999; Lin, 1991; Feder *et al.*, 1985). In addition, agricultural innovation adoption researchers in other Asian countries have proved the importance of informal social networks, especially at the individual level, for farmers to obtain information and make an adoption decision during the early stages (Maertens and Barrett, 2013; Schipmann and Qaim, 2010; Matuschke and Qaim, 2009).

Those factors affecting the adoption decision and adoption sustainability can be categorized in three groups of intrinsic, extrinsic and innovation characteristics (Girsang, 2005). Intrinsic characteristics are those of the innovation adopters, while extrinsic factors are those of the external environment impacting on livelihood vulnerability. Innovation characteristics include the five attributes of relative advantage, compatibility, complexity, observability, and trialability (Rogers, 1983; Girsang, 2005).

4. Rural livelihood adoption framework

As stated above, the current livelihood frameworks appear to not reflect explicitly the dynamic process of livelihood adoption and/or rejection strategies among rural communities. Therefore, we propose the Rural Livelihood Adoption Framework (RLAF) to combine the livelihood frameworks (DFID, 1999; Ellis, 2000) and the innovation-decision process (Rogers, 1983) in order to describe and analyse how a unit of adoption (i.e. individual, household or organization) can use livelihood assets to assess an innovation's attributes, and subsequently go through stages in the innovation adoption process within specific circumstances in order to obtain outcomes, and adopt or reject the inclusion of the innovation into the existing farming livelihood system.

The combination of these two frameworks, illustrated in Figure 1, is possible due to the fact that both are closely linked, especially for subsistence farmers seeking to diversify their income sources. In addition, both are related to and influenced by the common factors such as livelihood assets (intrinsic characteristics of the decision making unit), vulnerability context, and also the political and institutional context (extrinsic factors).

RLAF captures seven elements to describe a dynamic picture, in that an adoption unit uses the lens of existing activities, experiences ***(existing livelihood system)*** and ***outcomes*** (i.e. income, increased wellbeing, reduced vulnerability, improved food security, and more sustainable use of natural resources) through which to view and consider adopting a new livelihood activity. The unit is characterized with a specific set of ***livelihood assets*** (human, natural, physical, financial and social). Upon exposure to a ***new livelihood activity*** (innovation), the unit will consider its stocks of the five livelihood assets or capitals to study the innovation attributes of that new activity (relative advantage, compatibility, complexity, trialability and observability) throughout the ***innovation adoption process*** (from awareness, evaluation, decision, implementation, to confirmation (acceptance or rejection).

At the outermost layer, vulnerability and policy and institutional contexts are critical extrinsic factors influencing all the components in the framework. ***Vulnerability context*** encompasses trends, shocks and seasonality (DFID, 1999; Ellis, 2000). Needless to say, livelihood strategies, activities, and outcomes are strongly influenced by and also exert feedback effects on both perceived and actual vulnerability (Tang *et al.*, 2013). However, 'vulnerability is not a measurable concept' (Ellis, 2003a, pp. 5), and thus requires indirect indicators to assess the direction in which vulnerability is moving. In addition, the '***policy and institutional context***' is defined by structures associated with government (national and local), authority, laws and rights, democracy and participation (Ellis, 2003b). Scoones (1998) emphasizes

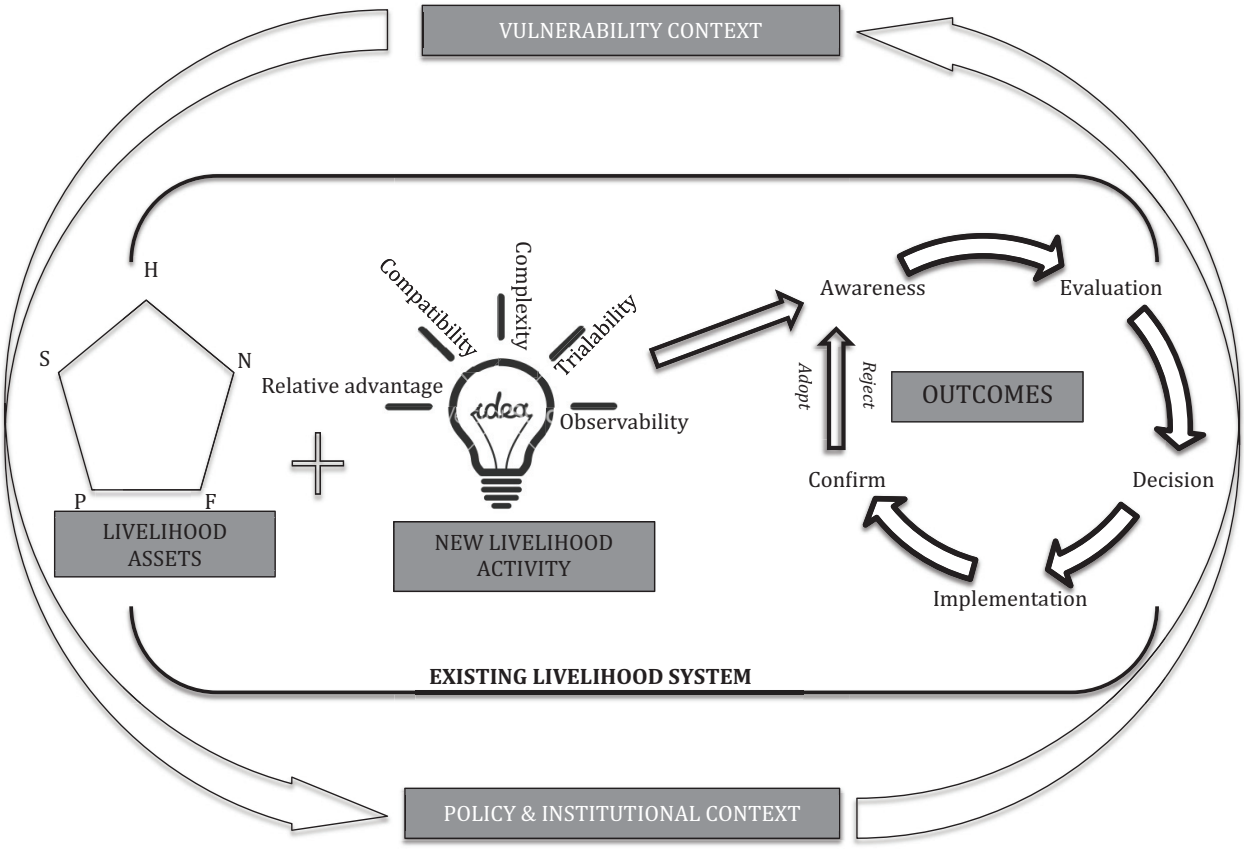

Figure 1: Rural Livelihood Adoption Framework (RLAF). **Source:** Adapted from DFID (1999), Ellis (2000) and Rogers (1983).

that institutions (laws, rules and cultural practices) may be formal and informal, and more importantly often ambiguous and fluid, which means institutions are continually being shaped and reshaped over time. Policy and institutional context is critical in the sense that it mediates access to livelihood resources and influences the portfolios of livelihood strategies or activities (Scoones, 1998; Ellis, 2000). Consequently, institutional context can either block / disable, or encourage / enable, and thereby improve livelihoods (Ellis, 2003a).

The '***innovation adoption process***' in the framework consists of the same five stages as Rogers' theory of innovation diffusion (Rogers, 1983). However, instead of considering five stages in a linear sequence, *the adoption process in RLAF is considered as a circle with an exit point at every single stage*, because innovation adoption at the micro-level should be seen from a dynamic perspective as an acquisition of information and a learning process (Feder *et al*., 1985; Marra *et al*., 2003) due to continuous changes in household and environmental conditions (Carletto *et al*., 2010). Consequently, the unit of adoption at each stage must seek and process information from its own and others' experiences, to reduce uncertainty about advantages and disadvantages of a specific innovation (Rogers, 1983, Warner, 1974 cited in Marra *et al*., 2003).

During the process, especially at the implementation stage, Rogers notes a common phenomenon of 're-invention' of the original innovation (Rogers, 1983). In other words, the innovation itself and thus perceived knowledge and awareness of adopters about the innovation are likely to evolve over time. Thus, adopters must continue to consider benefits and costs in implementing the new activity in order to modify their inter-temporal decision to adopt or withdraw (Carletto *et al*., 2010), which explains late adoption decisions after rejection, or discontinuance of an innovation after previous adoption (Rogers, 1983). In short, the innovation adoption process could be seen as a continuous process, without an end, like a cycle, in which adopters always need appropriate reasons to maintain and sustain a new livelihood activity in changeable contexts.

The preceding material establishes seven components in RLAF: livelihood assets, new livelihood activity or innovation, adoption process, outcomes, existing livelihood system, vulnerability context and policy and institutional context. Each component has a number of dimensions and indicators that help analyse and assess the corresponding component. While the dimensions are principal items, the indicators for each dimension need to be flexible or numerous in order to suit different types of livelihoods applications. For example, the livelihood assets pentagon elegantly and comprehensively represents the five dimensions at a conceptual level (Morse *et al*., 2009), but in reality it is not simple to analyse and measure livelihood assets because each form may contain many elements that are subject to context specificity i.e. likely to change from household to household, with geography and over time. In addition, Morse *et al*., (2009) argue that some assets, such as social networks, knowledge and good health, are not straightforward to measure. 'These asset categories are admittedly a little contrived, and not all resources that people draw upon in constructing livelihoods fit neatly within them' (Ellis, 2003b, p. 3). As a result, researchers can work according to the components or principal dimensions, but employ recommended indicators based on their own experiences and literature reviews to identify indicators to suit research topics and purposes.

5. RLAF application: Influential factors and barriers in the adoption of mushroom cultivation

Research subject

To investigate farmers' livelihood adoption experiences, the research chose the farming activity of mushroom cultivation being adopted by farmers in Giao Thuy district, Nam Dinh province, Vietnam. If agricultural innovations can be classified into three broad types of institutional, technological, and social innovations (French *et al*., 2014), mushroom cultivation belongs to the second type, which refers to the application of new technological practices to produce and market new goods.

Many communities in Vietnam have tried growing mushrooms. Amongst these, Giao Thuy was an interesting case for study, for several reasons. Firstly, this district has favourable conditions for growing mushrooms, and with production output of 270 tons in 2012, was the third biggest mushroom producer in Nam Dinh province, which is among the main mushroom production areas in the country (*Center for Advanced Science and Technology Application*, 2010). Furthermore, the district is home to Xuan Thuy national park, and many community development and livelihood projects including mushroom culture have been particularly designed for the local people here with the aim of reducing development pressures on the natural resources in the park. As a result, Giao Thuy farmers have far more financial, technical and institutional advantages to adopt new farming technologies, including to produce mushrooms, than many other communities. However, despite these natural and policy advantages, the sustained adoption of the practice has been low. Many farmers decided to discontinue the practice not long after adoption, others continued for only a few years, and relatively few have persisted to the present. Consequently, the adoption of mushroom culture as a livelihood diversification remains relatively infrequent and predominantly at a small production scale. Reasons for the limited success of the policy initiative are unclear. Based on these conditions, Giao Thuy is an appropriate site where livelihood adoption research can easily approach, identify and analyse the livelihood adoption process and influencing factors, especially constraints limiting long-term incorporation into livelihoods.

Research method

To investigate and analyse factors working both for and against the adoption and sustainability of mushroom cultivation in the area, the research was mainly about the *retrospective* and *circumspective* (Murray, 2002) to understand past experiences of households growing mushrooms in Giao Thuy. A dichotomous variable approach (Feder *et al*., 1985) was used to define the research population, which includes all the households or adoption units that had been farming any kind of mushroom species on various substrate materials in the research site, since initial introduction.

Tools to collect both qualitative and quantitative data in the research were purposive sampling combined with interactive semi-structured interviews, and a random

sample survey (Kanbur, 2005). Data collected in 2013 from the key informants indicated 84 households in twelve communes had adopted mushroom cultivation since the mid-1990s. To obtain representative and non-biased data from the survey, stratified sampling was employed to divide households into two groups based on their current status of mushroom cultivation: (1) currently inactive households which used to grow mushrooms, and (2) currently active mushroom farms. At the time of the study, there were 42 households in each group, reflecting a discontinuation rate of 50%.

Two phases of semi-structured interviews with key institutional (government and NGO) informants were also conducted in order to triangulate farm household findings, and gather enriching contextual information regarding policy, societal and commercial trends impacting farmers in the region.

The research conceptual model – RLAF – was the basis for exploring the livelihood adoption experiences among the mushroom farmers and the factors influencing their decisions at every stage. An array of indicators was assembled that reflected all components of the model. Many were adopted or adapted from previous studies, and others were devised specifically for this study. These indicators (Table 1) then informed development of comprehensive questionnaires and interview guides, and analysis of socio-economic and ecological information obtained in the research.

Livelihood adoption findings

Through the household survey, all the adoption factors and experiences of the mushroom farmers in Giao Thuy were identified and summarized in Table 2. At the early stage of the adoption process, farmers were attracted to mushroom cultivation because they perceived their assets endowment was sufficient for growing mushrooms, when combined with other supportive conditions including project funds availability. In order for a favourable attitude towards this new livelihood activity to persist, farmers needed to be able to perceive its relative advantages, in particular its potential for good income generation, and to estimate its compatibility with respect to requirements for skills and capital, through observation of neighbourhood successes. These findings reinforced the likelihood that each stage of the innovation decision process is impacted by certain sets of factors, particularly the characteristics of the decision-making unit at the knowledge stage, and perceived characteristics of the innovation (new farming practice) at the persuasion stage (Rogers, 1983; Rogers, 1995; Girsang, 2005).

An impression through responses of the local farmers was that there has been quite a number of livelihood development projects of NGOs, research and development institutions, vocational training centres, and Government extension organizations to stimulate this livelihood in Giao Thuy (Center for Advanced Science and Technology Application, 2010; Q. H. Dinh 2013 pers. comm., 16 July; X. T. Nguyen 2013 pers. comm., 20 October). Many famers (43%) adopted as a direct result of such projects and spillover effects. However, they received little follow-up extension support, even when they had been funded by such projects. Consequently, many farmers eventually dropped the new activity, pushing the cumulative discontinuance rate to 50%.

Following adoption of mushroom cultivation, all farmers reported developing concerns over the suitability of the innovation as they experienced problems with one or several farming stages from input acquisition, through nurturing and harvesting, to marketing of the products. They also began to realise their lack of various livelihood assets, such as finance (70% of respondents), knowledge, skills, physical facilities, and a reliable and adequate water source. Socio-economic data showed that the mushroom growing households in Giao Thuy were among the vulnerable groups that are characterized with low socio-economic status, low education level, and low change agent contact. In other words, they had all three critical characteristics of high discontinuers as described by Rogers (1995). Additional to the intrinsic constraints were the contextual factors of unstable markets (47%), unreliable input supply (30%), variable natural conditions (30%), and crop diseases (10%).

In terms of innovation attributes, the profit potential for mushroom cultivation was quite observable to the repondents, and thus attracted them to trial it. People can havest and sell mushrooms after only 1 to 3 months, and income is much higher than other conventional farming activities like rice growing (P. T. Vu 2013 pers. comm., 09 October). However, other characteristics were subsequently percieved to be incompatible with the farmers' limited assets, including a high labour requirement, high capital investment, and demanding physical and technical work. In addition, the local farming experience provided little support for the novel activity of growing mushrooms. This incompatibility was explained by a senior mushroom grower that ''our conventional farming activities are all outdoors, whereas mushroom cultivation is indoors and extremely sensitive to weather conditions and infections, and requires lots of attention just like taking care of a child'' (P. T. Vu 2013 pers. comm., 09 October). By that statement, the key informant emphasized that the mushroom farmers must change their habits, and apply a much stricter management regime to successfully grow mushrooms than required by other crops. These findings agree with Rogers' observation that difficulties at the implemenation stage, in institutionalising and routinising a new activity into the ongoing practice and way of life of adopters, affect subsequent sustained adoption. These dificulties are typically derived from the low compatibility of innovation characteristics with people's beliefs and past experiences, and negative perception about relative advantage (Rogers, 1995). Thus, mushroom cultivation to many farmers is a relatively high risk business, which requires high levels of investment of money, time, farm resources, labour and management attention, yet contains much uncertainty not only in the production process, but throughout the supply chain from input supply to fair market access, receiving an adequate price and earning a reliable income.

In short, the intrinsic and extrinsic constraints as well as the non-supportive innovation attributes identified in the research clearly explain the high rate of discontinuation among the mushroom growers in Giao Thuy district. These explanatory factors and their interactions all fit neatly into the components of RLAF to vividly tell a story about the major challenges in continuing growing mushrooms in this area (Figure 2).

Table 1: Research indicators based on the components and dimensions of the Rural Livelihoods Adoption Framework included in survey instruments

RLAF component	Dimension	Scale/Indicator	Characteristic	Adapted from:
Livelihood assets	Human (H)	Labour	Intrinsic	Ellis, 2000
		Skills		DFID, 1999
		Education		Lin, 1991
		Mushroom training		
	Natural (N)	Rice field	Extrinsic	Ellis, 2000
		Rice straw		DFID, 1999
		Water access		
	Financial (F)	Family wealth ranking	Intrinsic	
		Access to credit/cash (borrowed money for growing mushrooms)		Doss, 2006
	Physical (P)	Mushroom tent (size & materials)	Intrinsic	Aguilar et al., 2002
		Machinery (straw cutter, sterilization, drying)		
		Storage		
		Package		
		Transportation means		
		Road system	Extrinsic	
	Social (S)	Member of organization(s)	Intrinsic	Ellis, 2000
		Member of mutual group(s)		DFID, 1999
		Relationship with marketing unit(s)		
Livelihood attributes (Innovation)	Relative advantage	Profit	Innovation	Rogers, 1983
		Reduced cost		Rogers, 1995
		Reduced risk		
		Improved market access		
		Speediness of reward		
		Convenience		
	Complexity	Software: Knowledge/Information to do the livelihood	Innovation	
		=Suit knowledge/education		
		Hardware: physical attributes		
		=Suit labour and skills		
	Compatibility	Fit into existing livelihood system	Innovation	
		Suit past experiences		
		Fit into values/needs		
		Fit into lifestyle		
		Fit into social system		
	Trialability	Implement at small scale	Innovation	
	Observability	Observable degree	Innovation	
Outcomes from new livelihood	Livelihood security	Income level	Innovation	Ellis, 2000
		Income stability		
		Seasonality		
		Degrees of risk		
	Environment sustainability	Reduce straw burning	Innovation	
		Improve soil quality		
Adoption process	Awareness	Initial source of information		Rogers, 1983
	Evaluation	Information source for clarity		Rogers, 1995
	Decision	Scale trial		
	Implementation	Farmers seek information to reduce uncertainty		
		Problems and solutions		
	Confirmation	Adopt or reject?		
		Future plan		
Existing livelihood system	On-farm activities	Existence of on-farm activities	Intrinsic	Ellis, 2000
	Off-farm activities	Existence of off-farm activities	Intrinsic	
Vulnerability context	Shocks	Diseases	Extrinsic	Ellis, 2000
		Weather fluctuations		Ellis, 2003
	Trends	Regional economic trends	Extrinsic	
		Food (mushroom) consumption habits		
	Supply chain system (SC)	Buyers (wholesale, end consumers)	Extrinsic	
		Market types (local, cities)		
		Distance from market		
		Price instability		
		Input suppliers (spawn)		
Policy & institutional (P&I) context	Policies	Policies to support mushroom cultivation	Extrinsic	Ellis, 2000
	Intermediary	Local groups	Extrinsic	Rogers, 1983
		Extension services		
		NGOs		
		Private companies		
		Communication sources and channels		

Table 2: Factors influencing the adoption process of mushroom cultivation

Prior conditions	Awareness	Persuasion	Decision	Implementation	Confirmation	
Desire to create jobs and increase household income	1st awareness /impressions about mushroom cultivation to enable people to acknowledge it could be a relevant new livelihood	To encourage the livelihood adoption, people considered possibility to grow at least one specific mushroom species first	People decided to firstly try only one species at a suitable scale. After trial, people decided to either maintain the same or increase production scale.	Different stages in mushroom production: • Input acquition (substrates and spawn) • Mushroom nurturing • Harvesting • Proce ssing (could be omitted) • Selling	***For discontinuers*** (people confirmed to discontinue mushroom cultivation)	***For continuers*** (they could confirm to maintain the same production size (0), or plan to increase production (+) to suit their capacity)
Main Factors (ranked from the most to least important)	**Assets:** • H: labor, experience • F: financial capacity • N: available substrates • S: network (relatives'/ friends' supports) **P&I context:** • Project support • Spillover effect (Follow others) • Media **Vulnerability context:** • Good market	**Innovation characteristics:** • High profit • Simple technology • Easy product processing & storage **Assets:** • H: knowledge, skills • N: available substrates **Vulnerability context:** • Weather • Market		**Assets:** • F: low capital investment • H: limited knowledge, skills • P: poor/lack of physical facilities • N: lack of fresh water **Vulnerability context:** • SC: Market (unstable, unfair prices); supplier (insufficient, low quality) • Weather: storms, rain, humidity • Diseases: infection with mold **Micro-context:** • H: lack of labor (engage in other livelihood activities)	**Assets:** • H: lack of labor • P: degraded facilities • F: Low capital **Vulnerability context:** • SC: Market (unstable, unfair prices); supplier (insufficient, low quality) • Diseases: often at 2nd and subsequent crops • Livelihood replacement **Innovation characteristics:** • Relatively low income • Intensive physical work	**Assets:** • N: land (0/+) • H: labor, knowledge, skills (0/+) • F: finance (0) **Innovation characteristics:** • Compatible with current capacity (0) **Vulnerability context:** • SC: stable market (+) **Micro-context:** • No alternative livelihoods (+)

6. Discussion on the utility of RLAF as a research framework

The Rural Livelihood Adoption Framework (RLAF) is an attempt to integrate innovation adoption concepts into rural livelihoods study. RLAF was based on the well-studied frameworks of DFID's Sustainable Livelihood Framework and Ellis's Rural Livelihood Framework, which have been commonly applied in different rural contexts, especially in developing countries by the development agencies and institutes like DFID, UNDP, FAO, CARE, Oxfam, SIDA etc. (Neely *et al.*, 2004; DFID, 1999). We believe RLAF has advantages over other approaches in the sense that the theories and operations behind this integrative framework would be familiar to rural livelihood researchers and community development practitioners around the world, and thus it would anticipate fairly quick responses and/or applications.

The integrative framework contains seven components including livelihood assets, livelihood attributes, livelihood outcomes, adoption process, existing livelihood system of the research unit (i.e. household), vulnerability context, and political and institutional context. These components combine attributes of the sustainable livelihood concept and frameworks (Ellis, 2000; DFID, 1999; Chamber and Conway, 1991) and the diffusion of innovation theory (Rogers, 1983), which have been rigorously proved in research over decades. In order to test the comprehensiveness of the integration of these components and the utility of the expanded framework, the research on mushroom cultivation incorporated a significant number of open-ended questions to facilitate comprehensive information gathering. Respondents freely described their individual livelihood adoption experiences, including reasons for initial adoption or rejection, and for subsequent continuation or discontinuation. They described difficulties experienced during mushroom nurture, harvesting, processing and marketing, and in capital and technical aspects of their investments. All the provided information was analysed and found to fit neatly into the seven components and their dimensions. In other words, RLAF has demonstrated in this study its capability of capturing all the important aspects when a rural community adopted mushroom culture. This finding therefore helped confirm the relevance and comprehensiveness of RLAF in rural livelihood adoption research.

During the development and application of RLAF, we observed that while the dimensions of each component are principal and have been reconfirmed in many studies over decades (i.e. five types of livelihood assets, five attributes of innovations), indicators for each dimension must be rather flexibly developed to describe the uniqueness and complexity of different livelihood activities, as well as socio-economic and ecological contexts in which the livelihood activities are conducted. This emphasises the flexibility or openness of RLAF, thereby allowing researchers to apply RLAF for different types of livelihood activities in different situations. Consequently, the list of indicators is rather case specific, and based on literature reviews, researchers' experiences, and pilot study work. Thus, the indicators listed in Table 1 in this study were effective for analysing mushroom cultivation in Giao Thuy district, but may not be sufficient for other livelihood activities, or for the same activity in another location.

Nevertheless, the main components and dimensions of the framework would serve as a comprehensive guideline for researchers to identify indicators and formulate data collection methodology. Subsequently, at the data analysis stage, the collected socio-economic and

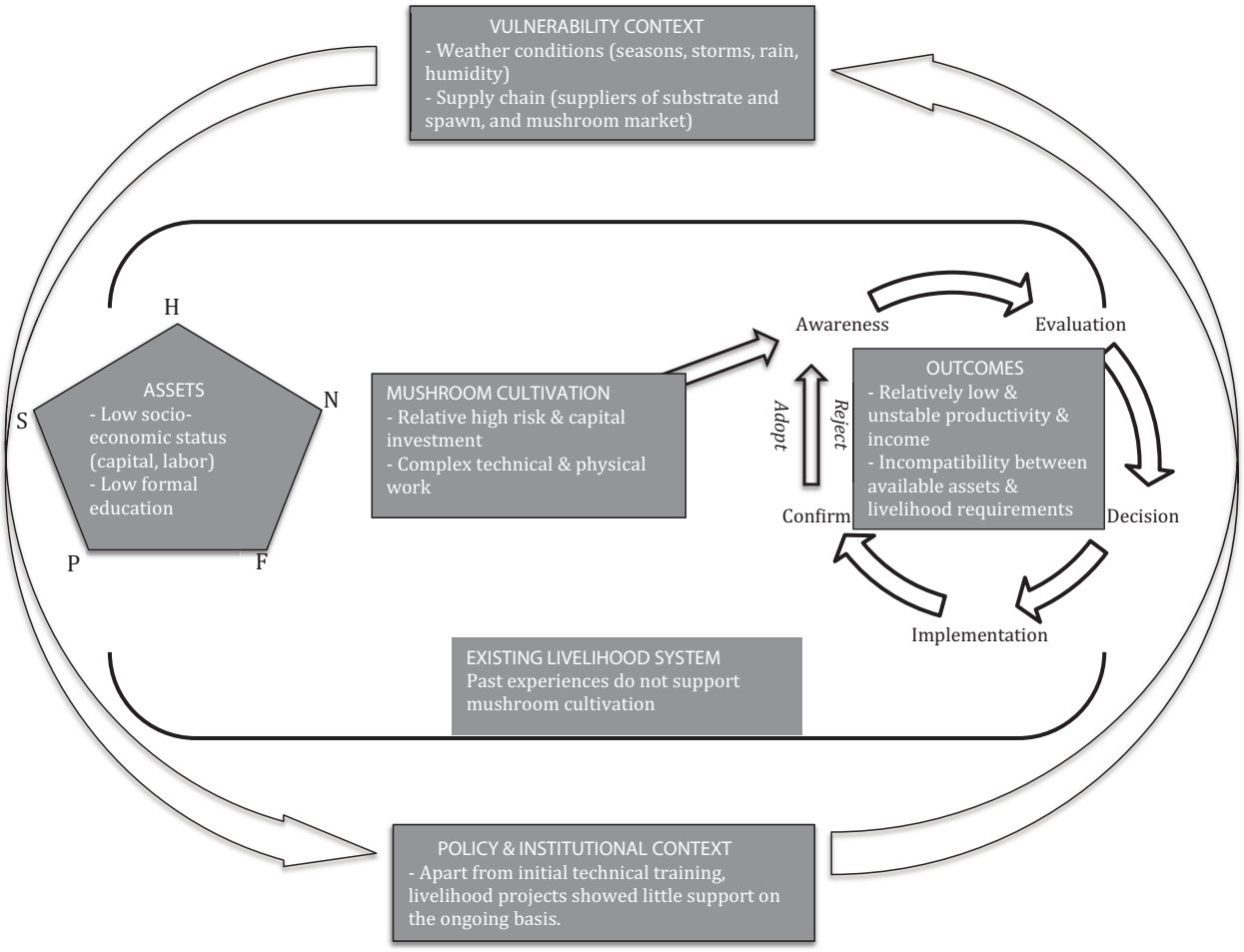

Figure 2: Critical barriers and constraints to continuing and developing mushroom cultivation.

ecological data could be conveniently matched with the corresponding indicators and components, which subsequently allow researchers to analyse interactions between livelihood factors, and systematically assess different aspects related to adoption and dis-adoption behaviours. As can be seen in the previous section, Figure 2 concisely illustrates how RLAF can support analysing the adoption barriers to continuing mushroom cultivation in one particular community.

RLAF does not take a snapshot of a particular livelihood activity, rather the framework has the capability to tell a story or describe a continuous process of how a livelihood activity was known within a community; subsequently, received favourable or unfavourable attitudes to be adopted or rejected; and if adopted how that livelihood was implemented, then sustainably integrated into household livelihood system or discontinued. The findings in the case-study not only identified factors affecting the adoption of mushroom cultivation in Giao Thuy district, but also enabled the detailed description of the continual changes among local farmers throughout the adoption process (from awareness, to persuasion, decision, implementation and confirmation). For instance, people at first were very confident in growing mushrooms. However, this perception was reversed among many farmers after a short period of implementation as they realized that their previous horticultural experience provided little preparational support for mushroom cultivation. Compared to conventional field-based farming activities, the new indoor livelihood contained higher risks, and required higher investment of financial, physical and technical capital. This clearly showcases the capability of the RLAF approach to capture and analyse the livelihood dynamics or livelihood on-going performance through indicators of the adoption process, and in conjunction with the other components.

Results from this study suggest that using RLAF can assist livelihood practitioners (both change agents and farmers) to analyse existing livelihood systems and constructively seek ways to improve problematic situations related to sustained adoption of innovations. RLAF allows systematic exploration of interactions among the adoption factors. As illustrated for this case study, Figure 2 explicitly indicates how appropriate solutions for the adoption barriers and challenges can be crafted and evaluated systematically. For instance, once external constraints on the mushroom farmers are identified, the change agents' task can be seen to expand to providing not only technical support, but also marketing and business management capacity training programmes. Concurrent changes to institutional and organizational settings are required to support mushroom cultivation on a continual basis (Scoones, 1998). The training programmes should be designed to significantly improve technical knowledge and skills for the mushroom farmers (human assets), thereby reducing the burden of technical and physical complexity of the mushroom growing activities (innovation attributes), and ultimately, increasing the compatibility of the innovation with existing local

livelihood experiences. In other words, use of RLAF enables design of an intervention that can target multiple issues simultaneously.

Another suggestion based on the results and illustrated in Figure 2 could be to conduct studies on the mushroom supply chain to identify bottlenecks and weaknesses in the current value stream (Bonney *et al.*, 2007; Brown *et al.*, 2010). Only a sufficient understanding about the current supply chain will enable the government, change agents, and supply chain partners to propose and implement good policies and actions aimed at improving the current situation of the mushroom producers and encouraging others to return to the activity, and thus promote enhanced livelihood sustainability.

7. Conclusion

Through a combination of the sustainable livelihood concept and frameworks (Ellis, 2000; DIFD, 1999) and the diffusion of innovation theory (Rogers, 1983), RLAF suggests an integrative framework with which to capture all the aspects of livelihood adoption research in seven components: assets, innovation attributes, outcomes, innovation adoption process, micro-context (existing livelihood system), vulnerability context, and policy and institutional context. RLAF succeeded in assisting the researchers to comprehensively analyse the adoption experiences, and then identify and assess various constraints in the process of sustained adoption of mushroom cultivation by the local farmers in Giao Thuy district, Vietnam. This case study is evidence of the holistic nature and practicality of this framework for rural livelihood adoption research.

RLAF as an action-oriented research tool has several strong attributes: (1) It is based on the widely recognised livelihood frameworks applied commonly in developing countries. (2) The integrative framework has capacity to assist practitioners to break down livelihood adoption problems into several components, and then measure the problems according to specific indicators. (3) Subsequently, RLAF can guide the collation of all the key findings systematically and their presentation in an explicit and comprehensive conceptual diagram showing interactions among the components. (4) As a consequence, researchers can readily construct a comprehensive understanding of the enabling and constraining factors affecting the adoption of an innovation. (5) This in turn supports crafting and implementing appropriate policies and effective actions to overcome identified constraints to adoption of worthwhile livelihood diversification strategies. It will also allow identification of inappropriate innovations whose promotion should cease.

In summary, the paper suggests RLAF as a practical framework for livelihood-enhancing innovation adoption research and rural development and management work. However, the results reported here can be regarded only as preliminary, as they are based on a single attempt to investigate farmers' behaviours and experiences in relation to a problem of sustained adoption and incorporation of an innovation into an existing farming system, in a small sample from one community in Vietnam. Therefore, further studies are required to examine the effective holism and applicability of the RLAF, not only for on-farm but also for off-farm activities, for other types of innovations, and in different contexts.

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