THE UNIVERSITY OF ADELAIDE

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ESTABLISHING AN EVOLUTIONARY LEARNING LABORATORY FOR LABOUR SAVING INNOVATIONS FOR WOMEN SMALLHOLDER FARMERS IN VIETNAM

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ABSTRACT

Various shortcomings have been revealed in many development efforts using conventional supply-driven and/or top-down approaches with linear vision in developing countries, including labour saving initiatives for the disadvantaged and marginalised groups. Various failures, unintended consequences and even counterproductive outcomes have been evident. Solutions and interventions tend to ignore local contexts, affordability, participation and needs of targeted groups. The inability of traditional approaches to deal with complexities and uncertainties of socio-cultural contexts, interwoven with relationships of both environmental and human factors across regions have highlighted a high need for developing and embracing more holistic and participatory approaches and structured frameworks to address complex problems.

In response to gender-biased labour hardship of women smallholders in the developing world, this study employed the systems-based Evolutionary Learning Laboratory (ELLab) approach, aiming at formulating the most economically, environmentally, culturally and socially appropriate systemic solutions to labour constraints. The latter is a prominent issue pre-determined by a funding body, for women small-scale farmers in rural areas of Haiphong, Vietnam. The first five steps of the ELLab were implemented with active participation of representatives of the target group and relevant stakeholders in the planning phase. This started from identifying issues, building local capacity, engagement and empowerment of the participants throughout problem structuring and decision making processes via a participative, interactive and co-learning environment towards developing a systemic management plan to address the real needs of the women farmers.

In-depth analyses through a baseline survey and a number of interactive workshops helped to understand and frame the context through developing a big picture (systems model) of the current situation. The model depicts a complex life situation and interconnectedness of various factors influencing the quality of life of the women farmers. Increasing income turned out to be the most urgent need, followed by the needs for reducing work pressure and improving health. Labour hardship was found just part of many interrelated issues. The decision making process with the aid of systems and relevant management tools enabled the participants to define systemic interventions and develop an overall systemic management

plan to address their real needs. The identified solutions support one another to address the labour hardship of the women and improve the quality of their lives as a whole.

This study has clearly proven the value and validity of the systems-based participative ELLab as an effective and powerful problem-structuring and solving framework to deal with complex problem across contexts and regions. It embraces bottom-up and participatory approaches in practice, builds capacity of local people and changes the mindsets of stakeholders involved from traditional linear and silo thinking to a more holistic and interconnected way of thinking that leads to appropriate actions and mutual collaboration. The study has addressed drawbacks of other approaches and provided substantial theoretical and practical contributions to various disciplines. These include community development, operational research, gender studies, agricultural systems research and development, participatory action research, project stakeholder and knowledge management, and organisational learning. It has also laid a strong foundation for future research in the mentioned fields.

DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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1. Ha, T.M.; Bosch, O. J. H. & Nguyen, N. C. (2015). Practical contributions of the systems-based Evolutionary Learning Laboratory to knowledge and stakeholder management, *Systemic Practice and Action Research*, 29(3): 261-275.
2. Ha, T.M.; Bosch, O.J.H.; & Nguyen, N. C. (2015). Establishing an Evolutionary Learning Laboratory for improving the quality of life of Vietnamese women in small-scale agriculture: Part I - The current situation. *Systems Research and Behavioral Science*, 33: 532-543 (DOI: 10.1002/sres.2346)
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CHAPTER I: INTRODUCTION AND LITERATURE REVIEW

1.1. INTRODUCTORY BACKGROUND

1.1.1. Introduction to the study context

In realising the millennium development goals of the United Nations, many efforts have been made to reduce poverty, improve education and health, adopt more sustainable practices, address gender equity and empower people to support poor and vulnerable groups in the developing world (Garrity, 2004; Leipziger *et al.*, 2003). It is reported that about 80% of the world's workforce lives in developing countries where agricultural production is their main livelihood (Behrman, 1999). There is a rather high proportion of people living under hardship. During the period 2010 to 2012 there were approximately 870 million people (about one eighth of the world's population) facing malnutrition (WHES, 2013). The majority of the poor in the world, earning below $1.25 to $2.00 per day, resides in Sub-Saharan Africa and South Asia (Sumner, 2012), of which many are classified as ultra-poor (SDSN, 2012).

These poorest regions in the world have rather similar agricultural systems, based on economies that are associated with high levels of poverty (Calzadilla *et al.*, 2013; Rosegrant & Hazell, 2000; SDSN, 2012) and malnutrition (Magadi, 2011; SDSN, 2012). Gender discrimination against women is also prevalent in these regions (Kabeer, 2003).

Due to a number of reasons, women in most of the developing countries, particularly in the two aforementioned regions, are usually the most vulnerable, suffering from several disadvantages. In many cases, however, they have proven to be more capable than men (Kabeer, 2003) and their work plays an important role in self-sufficiency and the wellbeing of their households (Kabeer, 2003). The discrimination is evident in various aspects such as lower remuneration, fewer employment opportunities in public services, lack of ownership and decision making, housework responsibilities, extended work hours and gender-selective investment in education (Kabeer, 2003).

Vietnam is among the top 20 poorest countries in the world (Sumner, 2012). It is situated in Southeast Asia where 75% of the population is dependent on agriculture, forestry and fisheries (Tran, 2009). The country is known for its ethnic diversity (Jiang, 2009; Kang & Imai, 2012; Van de Walle & Gunewardena, 2001) and four distinct cultures in four different

geographical regions (ASC, 2013). These differences influence the agricultural systems, characteristics of the farmers and their farming practices.

Farming systems in Vietnam are small and fragmented (MacAulay, 2006; Tisdell, 2009) with an average size of 0.24 ha per household (Dixon *et al.*, 2001). The systems are also susceptible to the adverse effects of recent extreme weather events that are probably due to climate change, causing food insecurity and other threats to the farmers (Tran, 2009).

Despite the endeavours of the government in equity improvement, indicated in the strategic development of "growth with equity" (Cuong, 2011; Fritzen, 2002), there has been a noticeable level of disparity in terms of service delivery to different ethnic groups (Kang & Imai, 2012; Van de Walle & Gunewardena, 2001), income gap between regions (Fritzen, 2002), and particularly the gender gap (FAO, 2010; Kabeer, 2003; Liu, 2004; SDSN, 2012). According to Kabeer (2003) rural women in Vietnam are also "tied to the village bamboo grove" due to their farming and housework burdens. These lessen their time and opportunities for other income generation activities and entertainment. In contrast, men are more mobile with a better range of off-farm employment opportunities.

FAO (2010) argued that women play a more important role in supporting the economy than men. Nonetheless, their contributions are not recognised in economic analyses. This is consistent with Kabeer (2003) who explored the drawbacks of macro-economic analysis via an "iceberg view of the economy", in which the productive activities of women are ignored. That is mainly due to the fact that their activities are usually in the form of unpaid jobs. In the developing world, these activities are assumed to be the "natural roles" of women to ensure family subsistence, reproduction and care.

1.1.2. Labour saving innovations and analyses of past failures

In recent decades, many labour-saving innovations have been introduced worldwide in support of rural lives and particularly that of women. These include (1) enhancing rural energy such as power grids, improved stoves and alternative fuel sources (Bishop-Sambrook, 2003; Carr & Hartl, 2010); (2) improving rural transport such as path and road improvement and the introduction of new means of transport (Fernando & Porter, 2002; Ragasa, 2012; Starkey, 2002); (3) on-farm activities such as improving farm practices; providing machinery for soil preparation, crop cultivation, harvesting and processing (Bishop-Sambrook, 2003;

Carr & Hartl, 2010); and (4) developing off-farm activities and/or rural enterprises (Carr & Hartl, 2010).

While it could not be denied that the above mentioned efforts have brought about some benefits such as improved productivity, production efficiency and reduced time burdens for various groups of women. However, many of these have been counterproductive due to unintended job losses and ownership shifts and poor adoption of the strategies. This is mainly due to, for example, cultural and social barriers. For instance, the introduction of plastic drum seeders in rice production in Vietnam had both positive and negative effects. The women of resource-rich groups could save much time and labour inputs from post-transplant gap-filling of seedlings and manual weeding. They had therefore more time to spend on other domestic and socio-economic activities. While at the same time, 50 to 100 per cent of the poor and landless women farmers lost their jobs on those farms (Paris & Chi, 2005). Similar outcomes were reported in Bangladesh during the 1980s when the advent of rice mills in the countryside resulted in around 100,000 jobless women per year (Carr & Hartl, 2010). Practicing conservation agriculture in Tanzania is another example in which minimum and/or zero tillage are practiced and jab planters are used. This led to job displacement of women who used to be hired to do planting and seeding (Carr & Hartl, 2010).

By reviewing 35 case studies worldwide with regard to labour saving technologies for women, Ragasa (2012) found that "accessibility, liquidity, profitability, suitability and socio-cultural factors" could all be hindrances to technology transfer and practical application. Bishop-Sambrook (2003) also recognised the gaps in articulation of labour saving innovations (devices & practices) with the capabilities of women in local settings in Africa. This author highlighted some mismatches and improper understanding of the capacities of beneficiaries (lack of knowledge of options and time constraints); purchasing and bargaining power; local culture (taboos) and traditions. Moreover, many barriers to the adoption of labour saving devices and practices have been revealed through the lack of access by women to information on the availability of tools (Carr & Hartl, 2010), cultural barriers to adoption of new tools and practices (Bishop-Sambrook, 2003; Carr & Hartl, 2010; Ragasa, 2012), ownership shift of labour saving technology to men (Ragasa, 2012), and the unaffordability for women of labour saving tools (Bishop-Sambrook, 2003). In Vietnam, Vien (2003) and Vien et al. (2006) asserted that the lack of consideration of local conditions, culture and

capacity have been a major factor contributing to the failures in technology transfer programs.

These failures would derive from biased viewpoints, reflecting the nature of linear thinking and/or "cause - effect" thinking ways of policy makers, researchers and developers. The supply-driven (top-down) approach is evident as reported in various studies (Anandajayasekeram, 2008; De *et al.*, 2005; Lemma, 2011; Semana, 1999; Swanson, 2008). For example, the technical specifications of manufactured hand hoes as regulated by the Kenya Bureau of Standards did not reflect users' expectations (Bishop-Sambrook, 2003). Additionally, the so called "dark age of pest control" in agriculture during the period from the 1940s to the 1960s (Kogan, 1998; Peshin *et al.*, 2009; Pimentel & Perkins, 1980) is another good example of "linear thinking", i.e. looking for immediate solutions or "quick fixes" without considering their impacts on other systems and subsystems.

A review of 25 years of experiences in developing technological devices for African women identified that the failures of many efforts lie in the lack of awareness of "the complexity of the roles of women, responsibilities within households and communities" and their "dynamics" in responding to different contexts (Doss, 2001). Likewise, Johnston et al. (2010) presented a range of external factors contributing to unexpected changes at the agricultural system level that reflect the complexity of the issue. Intrinsic and extrinsic factors and their dynamics should be taken into account for any labour saving initiative. Furthermore, Murphy et al. (2009) recommended a number of comprehensive approaches towards a more "appropriate technology" and considerations for adoption. However, the procedures and tools to solve the problems were not clearly presented.

1.1.3. Systems thinking and the Evolutionary Learning Laboratory as a new approach and framework to cope with complexity

Systems thinking (ST)[1], an approach that includes a set of tools for dealing with complexity (Maani & Canava, 2007), has been widely applied in various fields, including agriculture (Aronson, 1996; Bawden, 1991; Schiere *et al.*, 2004; Wilson, 1992) and rural development (Hillring, 2002; Kondratenko, 2003; Ruttan, 1984). ST provides a new mindset based on multi-perspective involvement (Bosch *et al.*, 2007b; Bosch *et al.*, 2013b; Cabrera *et al.*, 2008), leading to a comprehensive identification and understanding of root causes of

[1] Systems thinking will be described in more details in Section 3.5. – Theoretical framework.

multidimensional problems in complex systems and formulating appropriate measures to address those issues (Kondratenko, 2003; McNamara, 2012).

The systems-based Evolutionary Learning Laboratory (ELLab) facilitates mutual cooperation and learning amongst related stakeholders to comprehend and deal with intricate issues in a critical comprehensive manner, aiming at realising coordinated actions and sustainable results (Bosch *et al.*, 2013b; Nguyen *et al.*, 2011). The ELLab is a seven-stage reiterating cycle of collective thinking and actions, enabling people to experience in an experimental context to find optimal systemic solutions for addressing complex, multi-faceted and multi-partner issues (Bosch *et al.*, 2013b).

ST has been effectively integrated into the ELLab framework to cope with intricate matters in a number of fields such as sustainable development in Vietnam (Nguyen *et al.*, 2011), policy design for child safety in Japan, improving the reputation of a university school and tree density management in the rangelands of Australia (Bosch *et al.*, 2013b) to mention but a few.

To date, there has been no research on using ELLabs in labour saving innovations for women smallholder farmers. Although the Socio-cultural research (SRC) approach (described in Section 1.4) could be seen a similar methodology using a holistic approach, it does not provide clear steps and tools to address the root causes and formulating integrated systemic interventions. Therefore, application of the ELLab approach could address the afore-mentioned shortcomings of previous efforts in supporting rural women farmers. The participatory and/or bottom-up approach could help to ensure a shared vision and acceptance of actions amongst different stakeholders, while mutual learning, will occur during the decision making processes. Moreover, potential impacts of their proposed solutions would be tested via the co-learning environment of the ELLab towards developing a locally appropriate and operational systemic management plan.

One typical province, Haiphong, in northern Vietnam was selected for this study (see more details of the background in Chapter 2). The reflections and lessons learned from this case study will be disseminated and shared in different contexts in Vietnam and between Vietnam and Sub-Saharan Africa with a hope to achieve an advanced level of co-learning and management performance through a Global Evolutionary Learning Hub, Think2Impact^{TM} (http://think2impact.org).

1.2. RESEARCH QUESTIONS

It has become clear, during the process of conducting literature review, that complex issues such as finding economically viable, environmentally friendly, culturally acceptable and socially appropriate solutions cannot be addressed through traditional linear thinking that normally leads to quick fixes/treating of the symptoms. They require a systems approach for defining long-lasting (sustainable) systemic solutions. This hypothesis can be tested by determining the answers to the following questions:

1. What are the main drivers and barriers that influence labour saving innovations for rural women smallholders in Haiphong, Vietnam?
2. Can a systems approach, which will provide more systemically determined innovations, be used in an environment where the end users of the research have limited knowledge of systems approaches?
3. Will the use of the ELLab approach facilitate the adoption of appropriate labour saving innovations?
4. Is labour saving the main need of the women farmers?

1.3. OBJECTIVES OF THE STUDY

Overall objective:

- To identify the most economically, environmentally, culturally and socially appropriate solutions to labour constraints for women small-scale farmers in Haiphong.

Specific objectives:

1. Creating an ELLab for mutual understanding among stakeholders and for analysis of the current production systems and labour use of rural women, challenges and labour saving initiatives;
2. Building capacity for participants to apply basic concepts in systems thinking and systems model construction;
3. Formulating systems models in the research sites;
4. Interpreting and identifying the real needs of the women farmers;
5. Identifying leverage points/systemic interventions for addressing the real needs of the women farmers; and
6. Developing an implementation plan for addressing the real needs of the target group in the area.

1.4. THEORETICAL FRAMEWORK AND METHODS

1.4.1. Theoretical framework:

a) Rural community, farm households and farming systems

Since systems thinking with its holistic viewpoint will be used to determine interventions for achieving the formulated goals and objectives, its research setting in broader systems should be analysed. The context includes a social system and/or rural community where the women live, and farming systems where the majority of productive activities of the rural women takes place.

The words "rural" and "community" are defined differently depending on the country or region (Black & Hughes, 2001; Bryden & Bryan, 2005). In rural Vietnam, a community is seen as a locality with its own distinctiveness of customary, cultural and kinship relationships (Ngo & Pham, 2008). Villarreal (2000) found a strong influence of culture and tradition on agricultural production. He also took a holistic and interdisciplinary approach in his studies to address gender related issues, in which women were placed within a gender system. In turn the author pointed out that the latter belongs to a bigger system of a socio-cultural, economic, political and historic setting. Similarly, according to Gharajedaghi and Ackoff (1984), social system management is about development, realising the targets of not only the system itself, but also its constituents and its containing systems. Furthermore, FAO's socio-cultural research (SCR) was employed as an effective tool for interventions in rural development programs (Figure 1). SCR provides an "in-depth insight into why people behave as they do" since it offers a global view and analyses the factors within a specific context that all influence a household's decisions (Villarreal, 2000). In the study reported here, the same approach was used to analyse the contexts surrounding women in agriculture and determinants of behaviours to elucidate the underlying reasons for their decisions and actions.

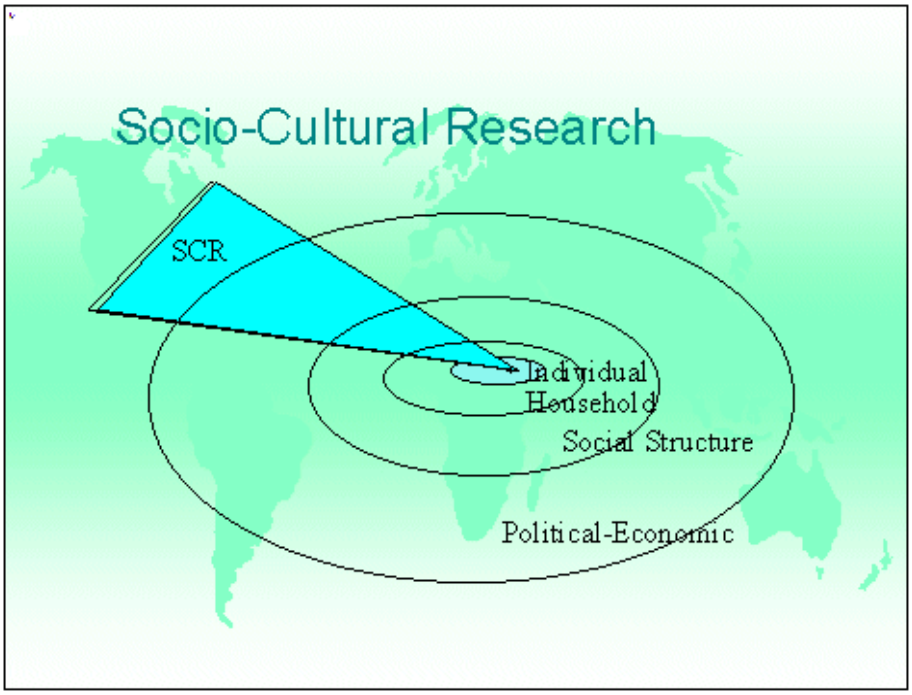

Figure 1.1 - FAO's Socio-cultural research (SCR) approach

(Source: Villarreal, 2000)

When looking for labour saving initiatives in the South East Asian region, Guerny (2002) realised the need to analyse elements of labour requirements from both micro (farm households) to macro (farming systems) levels where interventions may take place (Figure 1.2). This further affirms the importance of context analyses in formulating systems-based sustainable solutions.

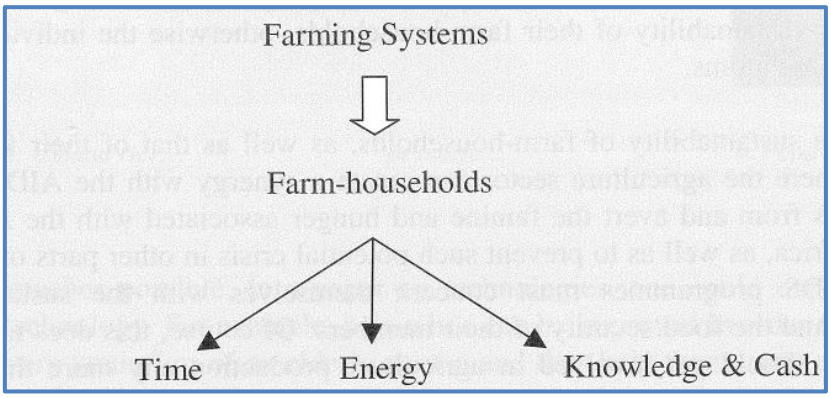

Figure 1. 2 - Areas of interventions for labour saving technologies

(Source: Guerny, 2002)

A farm-household can be seen as a system that consists of two components, a farm and a household (Guerny, 2002). Vien (2003) argued that non-farm work is another basic

constituent that has close linkages with the other two. The off-farm jobs can supplement or compete with the farm element in terms of resources (capital, labour), while providing additional income. In addition to the household basic needs and cash income, the farm holder's goals include meeting their social and cultural commitments (Collinson 1982, in de Bie, 2000). De Bie (2000) noted that the decisions of a farm holder are affected by his or her targets and "wants", natural (biophysical) conditions, available resources and socio-economic-political settings (Figure 1.3). This is consistent with Bland (2005), Koppelman & French (1996). Understanding the reasons for decisions of the farmers would therefore help to analyse the situations better that would lead to more appropriate and acceptable interventions.

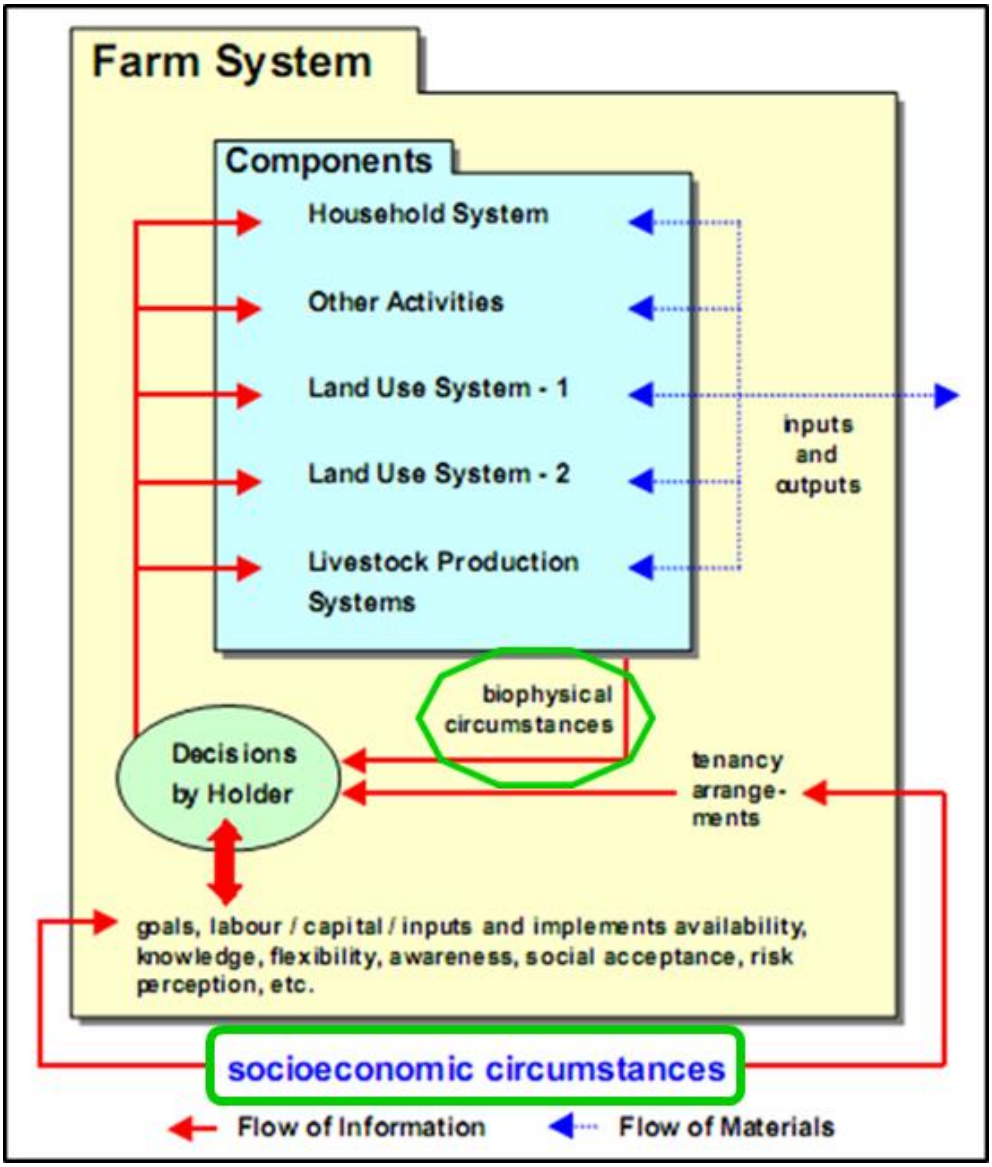

Figure 1. 3 - A farm-household structure and decision making by its holder

(Adapted from de Bie, 2000)

A farming system can be defined as "a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate" (Dixon *et al.*, 2001). Rice-based production systems are found to be dominant in rural Haiphong, which is a typical lowland area of the Red River Delta in Northern Vietnam (Chi & Fujimoto, 2012; FAO, 2002). The system has 1 to 3 rice harvests per year, depending on water availability. Other subsidiary crops such as vegetables, maize, root crops, soybean, sugarcane and fruit can be integrated in the system. Livestock and off-farm activities are also significant sources of household income (Dixon *et al.*, 2001).

Several studies showed that the priorities for development of lowland rice-based systems should be (in order of importance) (1) business diversification; (2) improved non-farm income; (3) enhanced resource management for high efficiency; (4) land consolidation for increased farm sizes; and (5) improved production management (Dixon *et al.*, 2001; Guerny, 2002). It therefore appears that labour saving for improved efficiency might not be the foremost priority in this system type and for the target group. Additionally, Lipton (1977), Fritzen (2002) and Thirtle et al. (2003) established that labour-intensive innovations and enhanced employment were recommended for the poor smallholders.

Likewise, by relating to Maslow's hierarchy of needs (Maslow & Herzeberg, 1954; Ventegodt *et al.*, 2003), it could be argued (from a systems thinking point of view) that supply-driven introduction of labour-saving technologies by the rural women for the purposes of reducing the time burden and life quality improvement, might not be adequate in the context where the rural poor are still at the bottommost basic level of needs (Figure 1.4). Accordingly, a bottom-up and/or participatory approach would be required to better address their needs.

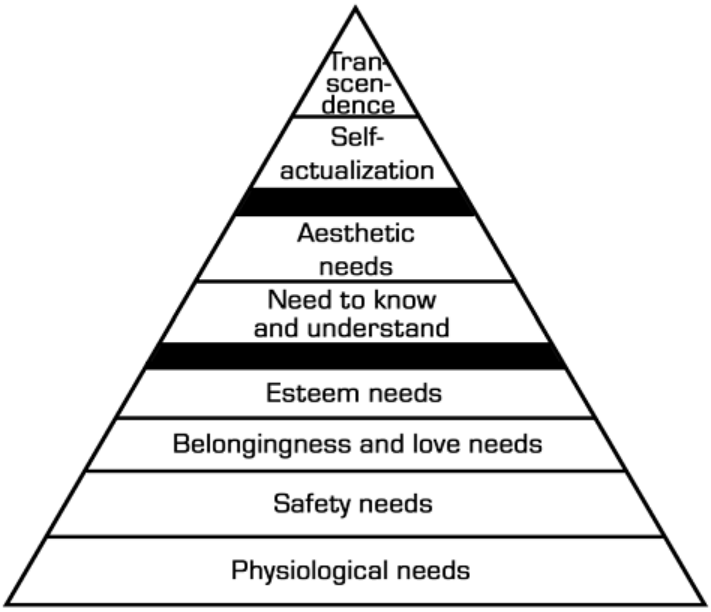

Figure 1. 4 - Maslow's hierarchy of needs

(Source: Ventegodt *et al.*, 2003)

b) Systems thinking

Rationale for the adoption of systems thinking:

Though being considered as an old concept, systems thinking (ST) has recently started to become embraced in various fields (Mingers & White, 2010; Nguyen & Bosch, 2012) owing to its appropriateness and validity in dealing with interconnected systems. It is considered as a "new" field of knowledge for comprehension and management of intricacy in the world of interdependency among different systems (Bosch *et al.*, 2007a; Maani & Canava, 2007). The evident failures caused by traditional simple and linear "cause-effect" thinking have lately led to a noticeably increase in the application of systems thinking approaches and participatory decision-making tools.

Conventional approaches focus on analysing constituent elements of a system in separation (Aronson, 1996; Bosch *et al.*, 2007a; Mai & Bosch, 2010), in which only the system structure is explored, while its functioning is ignored (Gharajedaghi & Ackoff, 1984). This view is consistent with Adams and Canava (2009) who asserted that a reductionist approach might skip critical elements within a complex system. Moreover, due to limited personal knowledge (Sterman, 2001) and/or inability to deal with complex issues (Bosch *et al.*, 2007a), people tend to jump to solutions in a single-minded manner that has led to many side-effects being overlooked (Sterman, 2001; Vester, 2007) and even counter-productive results (Maani,

2013). These were explained by Senge (1990) that "cause and effect are not close in time and space, that obvious solutions will produce more harm than good, and that short-term fixes produce long-term problems". In other words, there is always feedback in a system, "today's problems" might derive from "yesterday's solutions" (Sterman, 2001). The linear or simple cause-effect way of thinking that focus on immediate solutions that only treat the symptoms of a problem is regarded as quick fixes (Bosch *et al.*, 2013a; Bosch *et al.*, 2013b; Maani, 2013) and/or 'patch-up' approach (Vester, 2007). In the long run, these will become new problems as illustrated in the figure below.

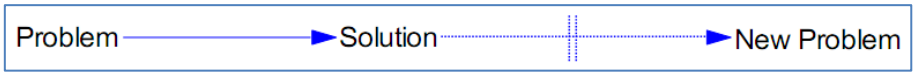

Figure 1. 5 - Traditional problem solving approach

(source: Maani, 2013). Note: *Symbol* ⟶‖ *indicates time delay*.

In contrast, a systems thinking approach employs a holistic outlook on the multi-aspects and interrelationships of complex issues (Bosch *et al.*, 2013a; Rubenstein-Montano *et al.*, 2001; Sterman, 2001). It helps discover the hidden causes under multi-dimensional contexts (Maani, 2013), making systemic interventions possible for sustainable outcomes (Bosch *et al.*, 2013a). For this, inclusion of multi-stakeholders, multi-disciplinary communication and cooperation will be essential (Bosch *et al.*, 2013b).

Adopting systems thinking to seek interventions for the target group (female smallholders) on labour saving in particular and understanding technology adoption in general, "hard" components (biophysical elements) and "soft" constituents (the interplays among the biophysical elements, technology, farm households and community) (Bosch *et al.*, 2007a; Bosch *et al.*, 2007b), are of equal importance in analyses. The all-inclusive view looks at both hierarchical properties of a system, where subsystems (components) belong to larger systems (e.g. environment, farming systems, agro-ecosystems and national economy) that provide settings and significance for decisions to be made, and the interrelationships among system parts (adapted from Bosch *et al.*, 2007b). Accordingly, this study does not merely look for interventions to lessen work burden (a perceived direct problem) for the rural female smallholders, but explore the whole system, that is, where the women reside, and identify interventions for improved performance of the system. To illustrate this point of view, Maani (2013) presented a systems-based problem solving loop to demonstrate the contrast with the conventional open-loop approach (Figure 1.5), in which the background (e.g. organisational,

social, and political,…) of a problem is analysed and shared among stakeholders and the root causes that are identified and unravelled.

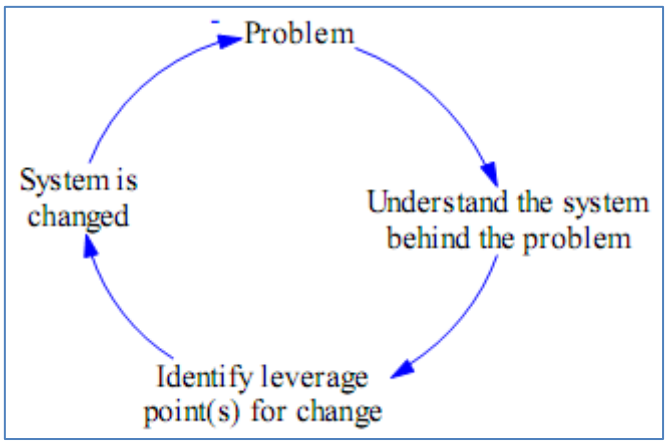

Figure 1. 6 - Systems thinking approach for solving problems

(source: Maani, 2013). *Notes: (-) indicates the problem is alleviated owing to systemic interventions.*

Levels of thinking:

The basic philosophy of systems thinking for systemic interventions lies in the four levels of thinking, as critically examined by various studies (Bosch *et al.*, 2013b; Cavana & Maani, 2000; Maani, 2013; Maani & Canava, 2007; Mai & Bosch, 2010; Testa & Sipe, 2006). The levels were analysed using an iceberg analogy, starting from events (the most visible part) to patterns, systemic structures and mental models (the bottom-most level) (Figure 1.7).

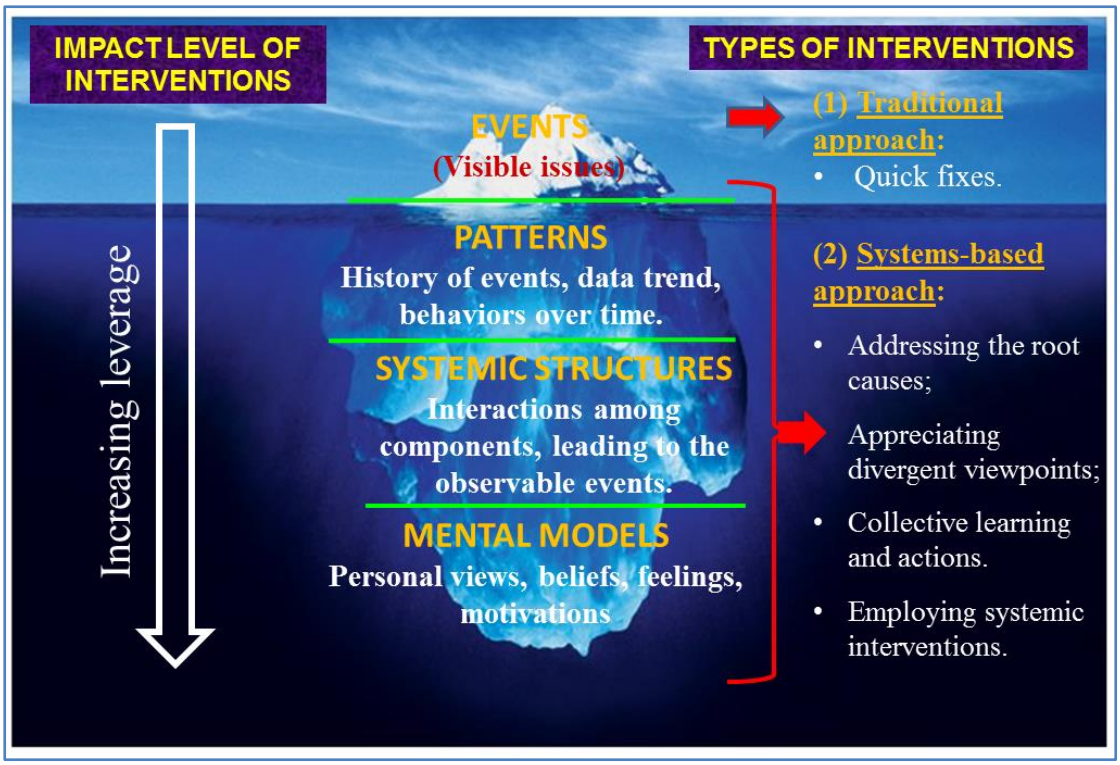

Figure 1. 7 - Four levels of thinking

(modified from Maani & Canava (2007) and Bosch et al. (2013b).

Events level: this can be seen as the tip of the iceberg, the most tangible and visible part. It provides a "snapshot of reality" (Maani & Canava, 2007), i.e. the "incidents" and "happenings/events" that draw people's attentions and thus instant responses (Maani, 2013). Those interventions are considered as "quick fixes" and/or "treating the symptoms" due to their ease of identification and implementation, yet sustainable outcomes would not be obtained (Bosch *et al.*, 2013b).

Pattern level: Patterns represent the behaviours and history of events over a period of time (Bosch *et al.*, 2013b; Maani, 2013). For instance, the technology adoption rate of smallholder rice farmers in Vietnam and the Philippines during 1995-1998 could be generally seen as an increasing trend by capturing the data points at the first year of technology introduction and the year of evaluation. However, continuous monitoring and evaluation of the adoption rate revealed a different trend (Figure 1.8). The SSR dryer was rapidly adopted due to its low cost and ease of use. In addition, cheaper energy supply (coal stoves) was used in replacement of electric heaters. While, the GH harvester failed to reach wider adoption in the first two years since it was very expensive, heavy and had an inappropriate wheel design. After ten modifications in terms of cheaper alternative materials, lighter weight and improved wheel

design that made the machine more mobile on muddy fields and, importantly, cheaper for farmers to purchase, it was rapidly adopted.

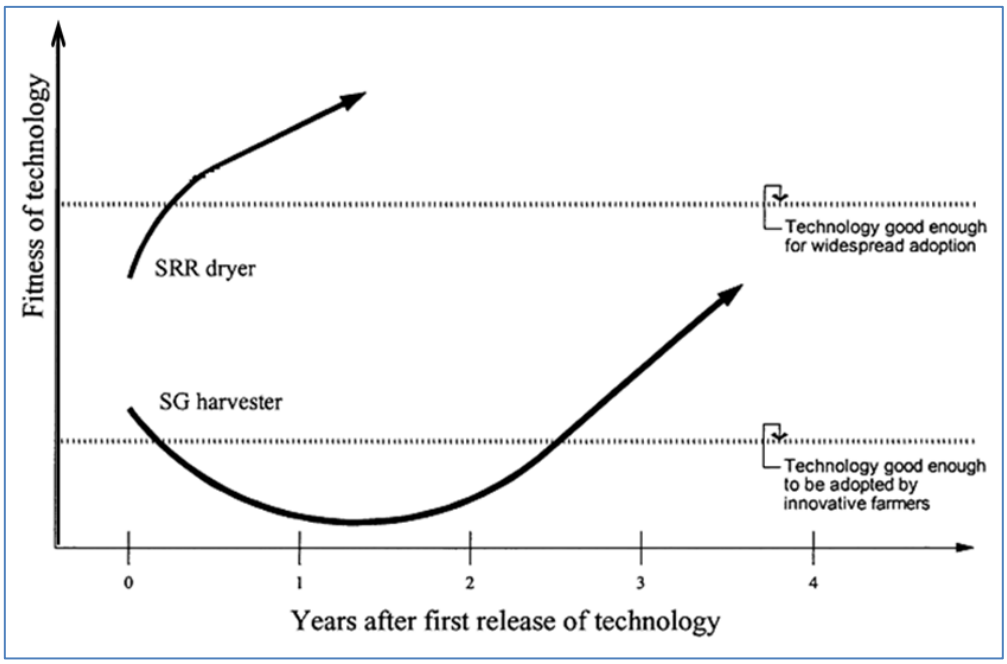

Figure 1. 8 - "Fitness" trajectory of new technologies and adoption by end-users

(adapted from Douthwaite *et al.*, 2001). *Notes: SRR dryers and SG800 harvesters were respectively introduced to rice farmers in Vietnam and the Philippines.* Innovative farmers (adopters) are the better-off producers who are venturesome, willing and could afford to adopt new technologies after the first hearing (Rogers 1995, cited in Douthwaite *et al.*, 2001).

Systemic structures: These represent the interrelationships among elements that induce the visible events and patterns (Bosch *et al.*, 2013b; Maani, 2013; Maani & Canava, 2007).

Mental models: This is the deepest level of thinking, characterizing "human factors", namely, beliefs, motivations, values, assumptions, hidden reasons behind people's decisions and actions (Maani, 2013; Maani & Canava, 2007).

The theory could therefore be summarized and adapted to the context of the proposed study as outlined in Table 1 below.

Table 1. 1 - Description of four levels of thinking and examples under this study context

Levels of thinking	Description	Examples of descriptors in the study context
Events	Visible problems; daily happenings.	Women labour hardship, labour saving options, rural-urban migration, low technology adoption rate.
Patterns	Behaviours over time;	Fluctuations of women's workload, migration; annual

	history of events.	patterns of pest & disease outbreaks.
Systemic structures	Interactions among factors and components that induce visible events.	Relations among production costs, market prices, production practice, producers' capability, local natural and cultural settings, policies and how they influence technology adoption.
Mental models	Personal views, beliefs, motivations.	Housework and childcare are the responsibility of women; household heads (husbands) take decisions on resource use.

(Source: adapted from Maani & Canava, 2007)

Leverage points and systemic interventions:

Sterman (2001) defines systems thinking as "the ability to see the world as a complex system". When looking for interventions to address a problem, the systems that are involved and their boundaries should be defined, since different components of a system are interconnected. Additionally, although the external (environmental) factors are not part of the system, they still affect the solutions to a problem because they influence the entire system (Rubenstein-Montano *et al.*, 2001). Bosch et al. (2007a) suggested paying attention to analysing issues and interrelationships within system boundaries, working with stakeholders from different hierarchical levels of the organisation of a system. In this sense, divergent mental models would be shared and thus a broad picture of how the system works would be perceived before leverage points can be identified.

Leverage points are defined as "points of power" or "places within a complex system (a corporation, an economy, a living body, a city, an ecosystem) where a small shift in one thing can produce big changes in everything" (Meadows, 1999). This author believed that identifying leverage points is a shortcut to overcome enormous hindrances. Beer (1981, cited in Gharajedaghi & Ackoff, 1984) implied those as a system "brain" which can, through a communication network, "activate" and "deactivate" other system constituents.

Leverage points occur in any type of system. Yet, they are not tangible and easy to define for actions to be taken (Nguyen & Bosch, 2012). However, leverages become apparent through the use of systems thinking and modelling that assist formulating appropriate systemic interventions (Maani & Canava, 2007).

Relating leverage to the levels of thinking (Figure 7), Mai and Bosch (2010) noted that the increase of thinking levels, from events to mental models, leads to higher leverage. Similarly,

Meadows (1999) enunciated that parameters and numbers (i.e. similar to those at the events level) are the points where interventions have the least impact. In contrast, system aims, power composition, regulations and culture (i.e. coincide with those at mental models level) are the locations where interventions have the greatest effectiveness.

Similarly, Harich (2012) compare the effectiveness between traditional linear thinking and systems thinking approaches through Figure 1.9 below. This author argues that complex social problems are difficult to be solved. Past failures in solving such complex issues are due to the lack of systems view and employment of system dynamic tools.

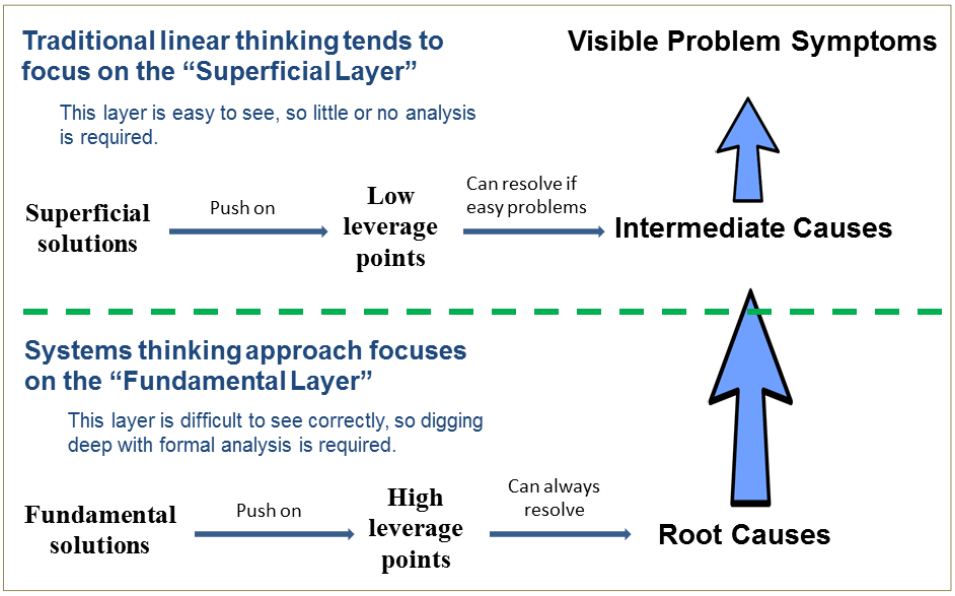

Figure 1. 9 - A comparative view between traditional linear thinking and systems thinking approaches

(source: modified from Harich, 2012)

1.4.2. The Evolutionary Learning Laboratory (ELLab)

In this section, a discussion is presented on the complete steps of the processes of the participatory systems-based ELLab framework to cope with complex problems.

As defined in the Introduction, the ELLab was developed as a systems methodology and a framework to realise informed and coordinated actions for sustainable results (Bosch *et al.*, 2013b). This was used as the core framework for the study being reported in this thesis (Figure 1.9).

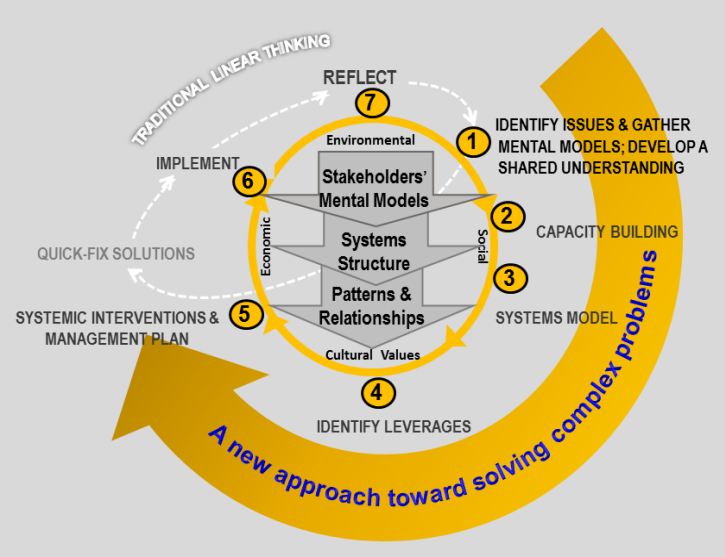

Figure 1. 10 - Evolutionary Learning Laboratory for Managing Complex Issues

(Source: modified from Bosch *et al.*, 2013b).

ELLab process step description

Step 1: Issue identification

Commencing at the fourth level of thinking (mental models), issues workshops and a number of dialogues with all relevant stakeholders are organised to collect their mental models of the problem in question to the workshops focused on the whole system and its operation, driving and restraining forces of the system and what individual participants think are feasible to address the issue (Bosch *et al.*, 2013b).

Step 2: Capacity building

This step is carried out for all stakeholders to be able to participate in the whole learning and action cycle. This step is regarded as crucial for members to "take ownership" of the outcomes (Bosch *et al.*, 2013b), which would lead to improved understanding, commitment and subsequently sustainability (Nguyen *et al.*, 2011).

Steps 1 and 2 of this framework would be considered as "awareness raising" stages. Participants should be aware that "those who serve the system are served and affected by it" (Banathy 1996, cited in Laszlo, 2001).

Step 3: Develop or refine systems maps/models

With the use of Vensim software (Ventana®, 2011), participants will, at the third level of thinking, develop a system structure and/or causal loop diagram based on the diverse "mental model" inputs from consultation workshops and dialogues with small groups and individuals (Bosch *et al.*, 2013b).

Moving to the "second level of thinking", participants will together look for "patterns", relationships among elements, and whether there are any feedback, reinforcing and balancing loops. This activity will help stakeholder groups to comprehend their interrelations and responsibilities for coherent strategies and actions (Bosch *et al.*, 2013b).

Step 4: Identifying leverage points/systemic interventions

Analyses and a thorough exploration of the developed system, nature of the relationships and loop types will enable participants to determine leverage points for systemic interventions (Bosch *et al.*, 2013b).

Step 5: Develop or adapt appropriate management strategies

Different systems-based solutions identified in the previous steps will be combined into an "integrated master plan". Bayesian Belief Network (BBN) modeling software (Cain *et al.*, 1999) will be used to assist the decision making process in the way that participants can test the possible consequences and/or impacts of the formulated systemic interventions (Bosch *et al.*, 2013b).

Step 6: Implementation

Tasks and responsibilities among stakeholders will be assigned after the operational plan has been developed (from the BBN models). A monitoring and evaluation plan will subsequently be developed to measure the activities and outcomes over the time (Bosch *et al.*, 2013b).

Step 7: Reflection

Although not part of this study, ensuring that the interventions and actions are appropriate, regular reflections on the progress and outcomes will be carried out for lessons learned and for dealing with emerging (unanticipated) issues under the

intricate and ambiguous conditions of our ever-changing world, through the ELLab process (Bosch *et al.*, 2013b). Maani (2013) considered this step as "the core of the learning cycle".

Interestingly, management strategies and policies can be refined and adapted via reflections. This will result in improved levels of learning and performance "at the local level". Participants are also made aware of how each study (ELLab) could be part of a "Global Evolutionary Learning Lab" for continuous learning and experience-sharing at regional and global scales (Bosch *et al.*, 2013b), using the web-based package Think2Impact™ (http://think2impact.org).

The practical application of the ELLab approach in the context of this study is described in Chapter 3. Detailed comments on its value and validity, as well as drawbacks of the approach are discussed in the following chapters.

1.5. CONCLUSION AND RESEARCH GAP

From the above analyses, it became clear that the conventional supply-driven approach still remains widespread. The complexity of the women's lives across cultural contexts has made the shortcomings of traditional linear approaches to become more evident through a myriad of failures and unexpected outcomes and impacts. The use of traditional linear thinking in finding solutions to the "perceived" labour hardship of the women smallholder farmers would be similar to many other development efforts in solving pieces of pre-determined visible problems in isolation. It will certainly lead to similar failures and even counterproductive outcomes.

General directions towards more "appropriate technologies" as stated by Murphy *et al.* (2009) seem rational to meet local needs with considerations of affordability, participation, appropriateness, sustainability, and gender inclusion. However, there is a definite need for a systems approach with clear guided steps to structure and address the kind of complex problems that the target group is facing. The ELLab, with its recent successful applications in other areas as presented above, can be seen as a valuable problem structuring framework via a systemic action research approach. Through following the complete process steps, it will promote true participation and co-learning among relevant stakeholders from problem structuring to decision making and planning of actions. In addition, the research design using

the ELLab methodology will help to address identified gaps in community operational research (COR) regarding the need for studying interactions among different facets of rural women's life in developing countries (White *et al.*, 2011) and other challenges in COR. These include, for example, developing feasible and acceptable solutions; resolving possible conflicting interests and goals; projecting consequences of developed actions; and addressing uncertainties (Friend, 2004).

1.6. OVERVIEW OF THE DISSERTATION

This dissertation is organised in six chapters. ***Chapter one*** (this chapter), provides an introductory background and literature review, and describe in general the main approach that was used for studying a complex problem of this nature. This is followed by four chapters, each comprising a scientific journal article, and finally a synthesis (conclusion chapter).

Chapter two presents a traditional problem solving approach through a baseline survey and detailed analyses of the current situation of women smallholder farmers in the research area. Although the proposed solutions were important, they provided separate and rather general guidance for interventions while the issues faced by the women farmers were found complex and multidimensional. As such, the traditional approach failed to address such complex problems. This article pointed out the need for a more comprehensive and systemic approach, providing a strong foundation and a rationale for the next chapter.

In ***Chapter three***, in-depth analyses of past failures in labour saving innovations worldwide are given to reveal evident drawbacks of the existing supply-driven approach with linear thinking. These were contrasted with the value and validity of the increasing use of systems thinking approaches and the generic systems-based ELLab. The first five steps of the ELLab were applied in the study context to unravel complexity of various factors influencing the quality of life of the women and to identify the real needs of the women farmers. Detailed steps to define systemic interventions and develop a systemic management plan for improving the lives of the women are discussed. This chapter also provides a detailed comparative analysis to provide evidence of the advantage of the systems approach over conventional linear thinking approaches.

Chapter four explores a broader perspective on understanding the farming systems and comparing general characteristics and determinants of the quality of life of women farmers in

both lowland and upland regions of Vietnam. The current knowledge gap in systems approaches and modelling tools in agricultural systems development in the region is discussed, providing a ground for embracing the approaches and tools. The comparative study provided insights for policy makers, professionals and practitioners towards identifying appropriate approaches and interventions to address challenges associated with women smallholder farmers in particular and agricultural systems in northern Vietnam in general. The comparative study clearly revealed the value of the ELLab as a useful methodology from structuring fuzzy problems to defining systemic interventions and developing an operational management plan. Its use to address complex problems in other regions of Vietnam and beyond is emphasised.

Chapter five discusses contributions of the ELLab to project stakeholder and knowledge management through the same case study. This chapter further highlights the practical value of this framework with regard to the flexible use of systems tools and relevant management tools to address emerging issues during project planning and implementation. Its contribution to filling the existing gap in transformative learning as well as its role in enriching action research in development projects are also discussed in this chapter.

The ***last chapter*** (six) consists of an overall synthesis of this dissertation. It provides general reflections on key findings and conclusions of all the contributing chapters. The chapter presents a summary of how the developed hypothesis and research questions have been addressed. Lessons learned, theoretical and practical contributions of this study are discussed. Research gaps and limitations are acknowledged and future research directions are presented to improve the processes involved in using the ELLab methodology in future studies on unravelling complex problems and finding systemic solutions that will have long-lasting outcomes.

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CHAPTER 2: ESTABLISHING AN EVOLUTIONARY LEARNING LABORATORY FOR IMPROVING THE QUALITY OF LIFE OF VIETNAMESE WOMEN IN SMALL-SCALE AGRICULTURE: PART I—THE CURRENT SITUATION

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By signing the Statement of Authorship, each author certifies that:

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CHAPTER 3: ESTABLISHING AN EVOLUTIONARY LEARNING LABORATORY FOR IMPROVING THE QUALITY OF LIFE OF VIETNAMESE WOMEN IN SMALL - SCALE AGRICULTURE: PART II – SYSTEMIC INTERVENTIONS

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CHAPTER 4: SYSTEM DYNAMICS MODELLING FOR DEFINING LIVELIHOOD STRATEGIES FOR WOMEN SMALLHOLDER FARMERS IN LOWLAND AND UPLAND REGIONS OF NORTHERN VIETNAM: A COMPARATIVE ANALYSIS

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System dynamics modelling for defining livelihood strategies for women smallholder farmers in lowland and upland regions of northern Vietnam: A comparative analysis

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ABSTRACT

This study aims to compare the main determinants of the quality of lives and livelihood options for women smallholder farmers between the lowland and upland regions of northern Vietnam. A systems approach and relevant systems tools were used to develop rich pictures (systems models) that depict the current situations and interrelationships amongst different factors within the systems. The comparative analysis showed similar and distinctive characteristics of the farming systems and women farmers in the two regions. Patterns of relationships and interplays amongst different variables reflect the complexity and multidimensional nature of the lives of the women, who are part of and influenced by the interwoven social, economic, cultural and environmental systems. The study provided insights and practical guidance for making "strategic decisions" towards sustainable agricultural systems and livelihoods of the target group in the respective regions. The systems approach, framework and process steps employed in this study are of a generic nature and can therefore be applied to solve complex problems in various other contexts around the world. Theoretical and practical contributions of using systems approaches in agricultural research and development are discussed.

1. Introduction

Vietnam has a poor and an agriculture-based economy in South East Asia. The country consists of >10 million small farms (Hazell, and Rahman, 2014). Agricultural production provides the major livelihood for the rural poor (Ha et al., 2015b). Small-scale rice-based production and land fragmentation are typical characteristics of the farming systems in Vietnam (Van Hung et al., 2007). (See Table 1.)

In the northern part, there are two distinctive regions. The Red River Delta (RRD) represents a flatland paddy-based production area, being ranked as the second largest rice production region in the country, where most of the major ethnic group (Kinh or the Vietnamese) resides (Chi and Fujimoto, 2012; Le, 2014). The Northern mountainous region (NMR) is the poorest region of the country with complex terrain forms and diversified cultures of >30 ethnic minorities (Vien, 2003). Local people are facing various challenges, particularly poverty, poor agricultural yields, land degradation (Yen et al., 2013) and distant markets (Castella et al., 2005). The NMR is divided into three zones, namely, high, low and mid-elevation mountain zones. Local people adapt their agricultural systems based on the specific environmental conditions and their traditional habits. Typical agricultural systems according to the zones include "rock-pocket agriculture", "composite swiddening" and "agroforestry" systems, respectively (Vien, 2003). Both the RRD and NMR share a common feature, namely a significant level of gender inequity, particularly women smallholder farmers in rural areas (Ha et al., 2015b; Trinh et al., 2015).

Development efforts in improving living standards of rural poor households and promoting gender equity have recently been given a high priority by the central and local governments (IFAD, 2013; Kelly, 2011). This is because gender inequity has been evident in many regions of the country, including the two aforementioned regions (FAO, 2010; Kabeer, 2003). Women are the major labourers in both domestic and production tasks. Their work burdens, together with the old customs against women, were reported to hinder their educational and job opportunities, participation in social activities, and access to productive resources. In contrast, men have more opportunities moving to work in non-agricultural sectors (Ha et al., 2015a; Thinh, 2009). Previous studies showed that the development of livelihood strategies and raising income for women farmers could improve their social status, decision

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Table 1
Differences in general characteristics of farming systems and main factors influencing the lives of women smallholder farmers in lowland and upland regions.

Indicators	Lowland region	Upland region
Biophysical conditions	Flatlands and ease of water access for irrigation that are favourable for land consolidation and mechanisation in agriculture to reduce labour input, production costs, improve efficiency and economy of scale to meet requirements of businesses (Ha et al., 2015b,d). Market access is relatively easier than that in the NMR.	Hilly and mountainous topography and rain-fed areas, and high production risks due to harsh environmental conditions and pest damages (Trinh, 2014; Trinh et al., 2015; Yen et al., 2013). Distant markets and limited access to information (Linh et al., 2015; Trinh et al., 2015).
Farming systems characteristics	Typical cropping systems in the lowland Red River Delta are irrigated rice-rice, rice-cash crop, and rice-maize systems (Le, 2014). In rural Haiphong rice-farming is the dominant production system (Chi and Fujimoto, 2012; FAO, 2002). The system has 1 to 3 rice harvests per year, depending on water availability. Other subsidiary crops such as vegetables, maize, root crops, soybean, sugarcane and fruit are often integrated in the production system. Livestock and off-farm activities are significant sources of household income (Dixon et al., 2001). Livelihoods of the women smallholder farmers in this area are dependent on crops (55.0%) (mainly rice and cash crops), and livestock production (30.3%) (Ha et al., 2015b).	Diverse agricultural systems associated with ecological zones and ethnic groups (Vien, 2003; Yen, 2013); High proportion of rain-fed production systems in hilly lands (Minot et al., 2006; Trinh, 2014). Rice, maize, cassava, sweet potato are staple food crops in the NMR (Yen et al., 2013). In which, rice contributes to 46% of total crop production value (Yen, 2013). Family farming and subsistence production is the typical agricultural system which is mainly based on manual family and animal labour. Farm outputs are mainly consumed by the family, small proportion of the outputs is sold or exchanged at nearby markets (Vien, 2003).
Farmers' characteristics (*socioeconomic aspect*)	The majority of women farmers and rural households in the lowland belong to the major ethnic group (Kinh or the Vietnamese) (Vien, 2003). Commercial production is evident in this region (Ha et al., 2015b).	Mainly ethnic minorities (approximately 30 groups) living in the region associated with high level of illiteracy, language barriers and subsistence production practice and thus poor yield (Trinh, 2014; Trinh et al., 2015; Yen et al., 2013).
Main determinants of the lives of women farmers (*socioeconomic*)	Three key determinants: Income, workload and health, in order of importance (Fig. 4).	Four key determinants: Food security, income, gender equity, and health & leisure (Fig. 5).
Food security (*socioeconomic*)	Food insecurity is not an issue of the women farmers in rural households in the lowland. This is probably due to the favourable conditions of flatlands and the ease of access to irrigation water for increasing the number of crops per year.	High proportion of households (32–70%) facing food shortage for 1–6 months in the selected communes of Phu Tho & Lao Cai. This is mainly due to high production risks, conventional subsistence production practices, inappropriate land use management and poor access to productive resources (Trinh, 2014; Trinh et al., 2015). These cause uncertain and poor yield (Fig. 5).
Poverty level (*socioeconomic*)	15.6% and 25.0% of the interviewed respondents belong to 'rural poor' and 'marginal poor' groups with an average income of less than USD1.0/person/day (Ha et al., 2015b).	Poverty rate in NMR is 43.9%, which is higher than the average rate (33.0%) of the northern provinces. However, the rate of ethnic minority community reached 67.4% (Nguyen, 2012).
Market situation (*economic aspect*)	Availability of potential local enterprises with high willingness for contract farming; Huge potentials for agricultural produce in both domestic and export markets. Therefore, market actor linkages via contract farming are feasible (Ha et al., 2015a,d). A number of specialised cooperatives have been developed in Haiphong.	Distant markets and asymmetric information due to the remoteness of the farming communities. Lack of market focus due to the subsistence production habits (Trinh, 2014). These would hinder commercial development of agricultural products.
Degree of gender inequity (*cultural aspect*)	There is still a significant level of engender inequity in terms of production and housework tasks. However, decision making power in production is not significant different ($P < 0.05$) (Ha et al., 2015b).	High level of gender inequity with a strong conception that women belong to kitchens and are not allowed to go to school. They also become main caretakers of their families (Trinh, 2014).
Supporting policies of the central and local governments	Recent favourable policies through development programs for both crop and livestock development. Land consolidation for the ease of contract farming with agribusinesses is currently in progress. However, some issues need to be addressed, including corruption and non-transparency during implementation of the support programs (Ha et al., 2015b). The extension network in this area can be evaluated stronger than that in the NMR. Yet, communication and coordination between the extension network with other local partners (farmers' associations and local authorities) should be improved (Ha et al., 2015b).	Inappropriate land use management has been reported as one of the major hindrances to livelihood development of the women smallholder farmers in the region (Trinh, 2014). This has been explained by the "top-down government policies" that ignore the actual conditions (biophysical and human factors) at the localities. Therefore, poverty is still an unsolved problem in this region (Yen et al., 2013). Extension services through training and technology transfer programs are available in the remote farming communities (Yen, 2013). However, this technology transfer efforts are questionable in terms of the relevance and quality of the education material. This also leads to low adoption rates of technology (Linh et al., 2015).

making power and improved quality of life, particularly in northern Vietnam (IFAD, 2011; Lapar et al., 2006).

Given that women farmers are part of rural households and farming communities, addressing issues faced by them requires a holistic and multidisciplinary approach. According to Spedding (1988, pp. 8–9), it is misleading to only focus on agriculture itself when studying an agricultural system. Due to its multi-disciplinary nature, agriculture involves mixtures of disciplines such as social sciences, economics, biology, etc. Furthermore, Villarreal (2000) has proven a strong influence of local culture on agricultural production. This author also highlighted the complexity of the situation in which gender-related issues were studied under a gender system. The gender system is part of and influenced by bigger systems in which relationships between sociocultural, economic, political and historic factors are all interwoven.

Many development efforts have been proven inappropriate due to the complex issues in agriculture and rural development in the northern region. For example, a lack of understanding of local conditions, culture and capability has been reported as main causes that led to various failures in technology transfer and livelihood development programs (Vien, 2003; Vien et al., 2006). Culas (2012) criticizes many drawbacks and failures in agricultural development projects in Vietnam, which are mainly due to the lack of a "multidisciplinary approach" from design to implementation. Few studies focus on "socio-agricultural dynamics and changes". Linear thinking in technology transfer that leads to unintended consequences on resource-poor women smallholder farmers has also been reported by Paris and Chi (2005). Therefore, various issues in agriculture such as the vicious cycle of poverty, negative debts, unsustainable livelihoods and gender inequity are still unresolved problems that affect many disadvantaged groups, particularly the women smallholder farmers in many regions (Bosch et al., 2015).

Taking the above into account it is clear that a more holistic and multidisciplinary approach is required for better understanding of the context and subsequently the nature of interventions that are required. Systems thinking approaches, modelling tools and decision support systems have been used in agricultural systems research and development around the world (e.g. Bawden, 1991; Eastwood et al., 2012; Florin et al., 2013; Lamprinopoulou et al., 2014; Macadam and Packham, 1989; Mainland, 1994; Paracchini et al., 2015). However, so far no study has

been conducted using systems dynamics modelling to analyse and compare the complexity of women farmers' determinants of life and the interactions amongst different subsystems beyond the production systems in the two regions of Vietnam. This study will contribute to addressing the current knowledge gap through an in-depth analysis of the women's situations and provide both policy and practical recommendations to improve their livelihoods and quality of life.

Due to the distinctive differences in terms of natural, social and cultural characteristics between the lowland and upland regions, farming systems and specific challenges of women farmers in the two regions reveal their own nuances (Ha et al., 2015b; Trinh, 2014). This study therefore aims to compare general characteristics and the main determinants of the quality of life of women farmers and provide insights for defining appropriate livelihood options for each region using a systems approach.

2. Approach and methods

2.1. Overall approach and study locations

The study employed a systems approach with relevant systems tools (described below) in two regions, lowland and upland (Fig. 1) of northern Vietnam. Haiphong is a typical lowland province in the Red River Delta. The province has a total natural land area of 1519 km^2, including two islands, with an average elevation of 0.7–1.7 m above the sea level. Flatland constitutes 85% of its total land area. Haiphong is situated in the typical sub-tropical region of northern Vietnam with an annual average temperature of 23 to 26 °C (depending on seasons). A population of more than two million was reported in 2016 (Gregorich, 2016). Four rural districts of Haiphong, namely, Kien Thuy, An Lao, Vinh Bao and Tien Lang, were selected that represent the typical lowland area where there is a relatively large proportion of smallholder farmers, the key target group of this study.

Phu Tho and Lao Cai provinces represent the northern upland and/or northern mountainous region (NMR). Phu Tho is a typical midland province located in the sub-tropical monsoon region with an average temperature of 23 °C and annual humidity of 85% (FAO, 2012). The province has a population of 1351 people, being one of the poorest provinces in the Vietnam (GSO, 2013). The province's total natural land area is 3533.3 km^2 (GSO, 2013). However, only 54.8% is considered arable for production (FAO, 2012). Meanwhile, Lao Cai represents an upland province with the total land area of 6383 km^2 (GSO, 2013) and an average annual temperature of 23 °C (DARDLC, 2012; FAO, 2011). The province is a mosaic of 33 different ethnic minority groups (LCPPC, 2011), contributing to roughly 65% of the total population (656,900 people) (Culas, 2011; GSO, 2013). This province is one of the top-five poorest provinces of Vietnam (Phi, 2012).

In Phu Tho province, Tan Son district was chosen. Bac Ha and Sa Pa districts were selected in Lao Cai province. These three districts are amongst the poorest districts of Vietnam (CEMA, 2010; UN, 2013). Women farmers in these districts are the most vulnerable group (Trinh, 2014).

Due to the above mentioned reasons, women smallholder farmers in both regions were chosen as the target group for this comparative study.

2.2. Process steps carried out in the lowland

The case study in rural Haiphong was conducted following the first five steps of the Evolutionary Learning Laboratory (ELLab) (Bosch et al., 2013). The process started from identifying issues and gathering mental models of relevant stakeholders via both baseline surveys and stakeholder workshops to develop a shared understanding of the current situation of the women farmers (Step 1). Representatives of the appropriate stakeholders were selected for capacity building and learning-by-doing activities throughout the ELLab cycle (Step 2). Ventana® (2011) and Netica™ software (Norsys, 2013) were used to support

Fig. 1. Map of the research locations. Red star represents the research location in the lowland (Haiphong, the Red River Delta); Yellow stars represent the research locations in the upland (Northern Mountainous Region) (Source: Adapted from Clement and Amezaga, 2013). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

the development of systems models of the current situations, defining levers for systemic interventions and developing an overall management plan (Steps 3–5) (Fig. 2).

In response to the requirements of the funding body (Gates-Foundation, 2013), which focused on labour saving innovations and strategies for women smallholder farmers, the selection criteria of participants in the ELLab processes were discussed and agreed between the research team and the local partner, the Department of Agriculture and Rural Development. Those include (1) being smallholder farmers in the research area; (2) geographic representation of participants/informants; (3) balanced representation of ethnicity (if any); and (4) balanced representation of rich, fair, and poor participants within the smallholder women farmers in the area.

Both qualitative and quantitative data collection methods were employed through a baseline survey with 33 smallholder farmers prior to a number of stakeholder workshops and separate mini-workshops or forum discussions with women farmers in the four rural districts. The baseline survey provided background information on the profile of households, current production status, market outlets, gender-related issues, and labour use. The plenary workshops were organised with the participation of 75 representatives from the local government departments and organizations, input/service providers, women farmers, and agribusinesses in both Haiphong and a neighbouring province, Hai Duong. Representatives of agribusinesses were later engaged in the ELLab process due to the initial findings that highlighted the need for improving income via market actor linkages.

The mini-workshops were conducted in each district with the participation of 36–40 women smallholder farmers for more in-depth understanding of their real challenges, expected solutions and how they are ranking what they regard as priorities.

2.3. Process steps carried out in the northern mountainous region

The case study in the NMR is a follow-up research activity from a baseline study on impacts of vegetable farming on livelihoods of women farmers in two selected provinces, Phu Tho and Lao Cai (Trinh, 2014). However, by using a systems approach, the follow-up analysis provided a broader picture and interrelationships of all factors determining the livelihoods of the rural women rather than a mere focus on production of a single crop.

In addition to the main variables defined from analyses of the baseline study (Trinh, 2014), relevant secondary data were collected from reports and other published sources of different international and domestic organizations, such as the Australian Centre for International Agricultural Research (ACIAR), Vietnam Women's Union, Vietnam Academy of Agricultural Sciences, Provincial Departments of Agriculture and Rural Development, and previous studies in the two provinces to support findings. Vensim® software (Ventana®, 2011) was used to develop a causal loop diagram (CLD) that depicts the current situation, highlighting patterns of relationships and potential levers for systemic interventions to improve their lives.

2.4. Description of concepts and their implications

The *patterns of relationships* denote how different variables are interlinked and the nature of feedback loops that are formed, either reinforcing or balancing loops (Bosch et al., 2013). The *reinforcing feedback (R) loop* represents positive feedback, showing "growing or declining actions". In contrast, the *balancing feedback (B) loop* indicates negative or counteracting feedback, which "seeks stability or return to control, or aims for a specific target" (Maani and Canava, 2007: 33). For example, Ha (2008) reported the traditional habit of many Vietnamese farmers that applies untreated farmyard manure into their ponds. The conventional practice causes a number of environmental and health concerns in rural areas. Fig. 3 illustrates two types of feedback loops. Applying untreated manure causes pond water pollution in the long run. In turn, the latter induces a higher number of dead fish due to the polluted water. The more fish dies, the worse the pollution of water becomes. This feedback creates a reinforcing (R) loop. The polluted condition of pond water and the increased number of dead fish influence farmers' awareness. Therefore, application of untreated manure is reduced (balancing loops, *B*1 and B2, Fig. 3), seeking alternative methods that are more environmentally sound.

The patterns of relationships help to explain causal relationships and interactions between different variables within a subsystem. They also show interplays amongst factors in the subsystems. Analyses of these patterns enabled participants to understand the nature

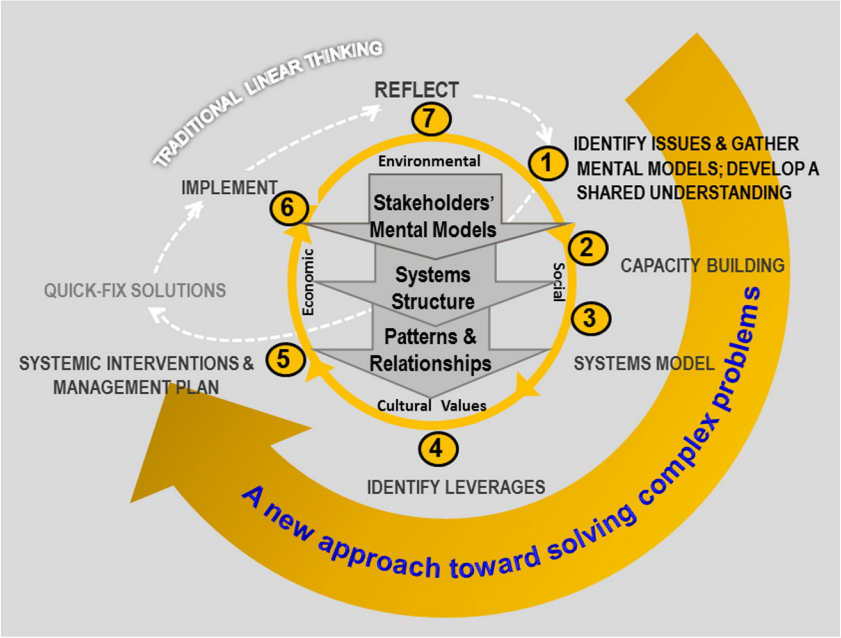

Fig. 2. Evolutionary Learning Laboratory for Managing Complex Issues under conditions of interwoven relationships between economic, social, environmental and cultural factors (Source: modified from Bosch et al., 2013).

of interconnectedness between different factors and the outcomes/consequences of an intervention.

The *leverage points* are defined as "points of power" or "places within a complex system (a corporation, an economy, a living body, a city, an ecosystem) where a small shift in one thing can produce big changes in everything" (Meadows, 1999: 1).

Identifying the leverage points within a system helped to develop a systemic action plan for coordination of proposed systemic interventions that produce high impacts towards achieving the defined goal. It seeks to improve the whole system performance rather than the traditional approach of linear thinking, leading to "quick fix" solutions and various unintended consequences and even counterproductive outcomes (Bosch et al., 2013; Ha et al., 2015c; Maani, 2013; Sterman, 2001; Vester, 2007).

3. Results and discussion

3.1. System dynamics model of the current situation of women farmers in the lowland

Fig. 4 shows a systems model developed from the synthesis of all mental models of the women farmers and related stakeholders concerning different issues affecting the lives of the women in rural Haiphong. Analyses of relationships patterns revealed the interwoven relationships and interplays amongst the variables.

Low income, high work pressure and poor health were, in order of importance, determined as the three major challenges that the smallholder women farmers are facing. Therefore, raising income, reducing workload and improving health were set as the three main objectives to achieve the goal of improving the quality of life of the women.

The systems model enabled participants to better understand the current situation, interrelationships amongst the variables and the need for engagement of all relevant stakeholders. The identified patterns of relationships helped the participants to determine potential important factors (red variables, Fig. 4) that can change the system's performance.

The results clearly show that factors determining the quality of life of the women farmers are way beyond their production systems. Their production-related labour hardship, the focus of the funding body, is just part of the big picture of interrelated factors that altogether influence their lives (Fig. 4). The women's uttermost need is to raise their income through improved market access, which can address many other issues. Their increased income was stated to strengthen their financial capacity for investment in production and access to productive resources. It will help to improve production efficiency and thus reduce cost and increase savings (*R*3, Fig. 4). The raised income implies a higher status within their family, resulting in better family support and work sharing. As a result, their work hours are lessened, creating more opportunities for them to earn additional income via secondary jobs (R2, Fig. 4). The reduced workload enables them to participate in social activities and organizations that will improve their knowledge, skills and subsequently status. This could lead to improved gender equity, gradually removing old customs against women and thereby better family support and work sharing (R1, Fig. 4). The results are consistent with finding of Lapar et al. (2006) and IFAD (2011, 2013) in other provinces in northern Vietnam. In addition, the improved production efficiency reduces their work pressure and therefore improved health, which in turn further enhance production efficiency (R5, Fig. 4).

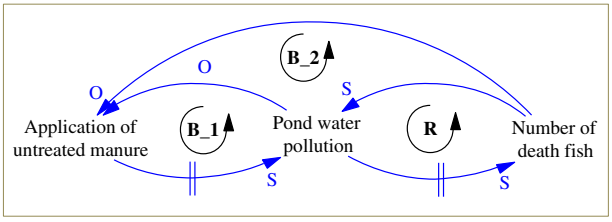

Fig. 3. Example of reinforcing (R) and balancing (B) feedback loops through the traditional practice of Vietnamese farmers applying untreated farmyard manure into their ponds. *Legend: Arrows (→) indicate the causal links; Arrows with a double vertical bar (‖) represent a time delay; S — same direction; O — opposite direction.*

The developed model helped all the stakeholders to understand their role and areas of possible support that need their involvement. Further steps in defining systemic interventions, testing future scenarios for developing an integrated management plan towards the end goal are presented in Ha et al. (2015c), which is beyond the scope of this article.

3.2. System dynamics model of the current situation of women farmers in the northern mountainous region

Due to the specific challenges in the upland, local people, particularly women farmers, have to face a range of difficulties. There are many hindrances to livelihood improvement. Those include distant markets, inappropriate cropping structure, production risks, limited literacy level, language barriers, gender inequity, small landholdings, subsistence production habits, and food insecurity (Trinh, 2014; Trinh et al., 2015). These issues were multidimensional and intertwined with one another. Together they influence the lives of the women in particular, rural households and farming communities in the NMR in broad terms.

Food security, income, equity, and health and leisure were determined as the key determinants of the livelihoods of the women farmers in the NMR (Fig. 5).

The systems model developed following the analysis of the baseline survey has provided a 'big picture' of the current situation, highlighting patterns, relationships and potential important factors (red variables, Fig. 5) that could leverage performance of the whole system. Interventions focusing on these factors would be expected to yield high impacts on improving the quality of life for the women and farming households in the highland (Fig. 5).

Due to harsh biophysical conditions in accordance with the traditional subsistence production habit of local residents in this region, food insecurity was stated as the most challenging issue, in which a large proportion of households have to face several months of food shortage (Trinh, 2014). Addressing this issue through mainly enhancing production efficiency and reduced production risks can be considered critical before addressing their need to raise income and others.

Productivity and yield of agricultural products are important for food security. Improving production efficiency would be the key to address the current issue of poor yield. This requires policy support in terms of access to productive resources, production technology and extension services (including capacity building) to help change their subsistence production habits and cropping structure to be more commercial and profitable, and thereby have more secure and increased income (Fig. 5). The results are consistent with findings of Minot et al. (2006) and Nguyen (2012) in the NMR. The increased income would enable the smallholder farmers to access production technology that would directly lead to improved production efficiency (R2, Fig. 5). Their access to improved technology also helps to reduce their production risks, resulting in more secure and increased agricultural yield. This would be a motivation for them to adopt production technology (R1, Fig. 5).

Their improved production efficiency and income would result in improved health and leisure time for the women. Bosch et al. (2015) found that increased income enables women smallholder farmers to have better access to healthcare services, while improved production efficiency lead to more free time. In this case study, their enhanced health and leisure would enable the women to participate in other income activities to raise their family income (R5, Fig. 5). Their raised income would also improve their social status, promoting gender equity, which results in better access to productive resources and thus income (R4, Fig. 5). Their raised social status and more equity would lead to reduced housework burdens and thus more time for social and education

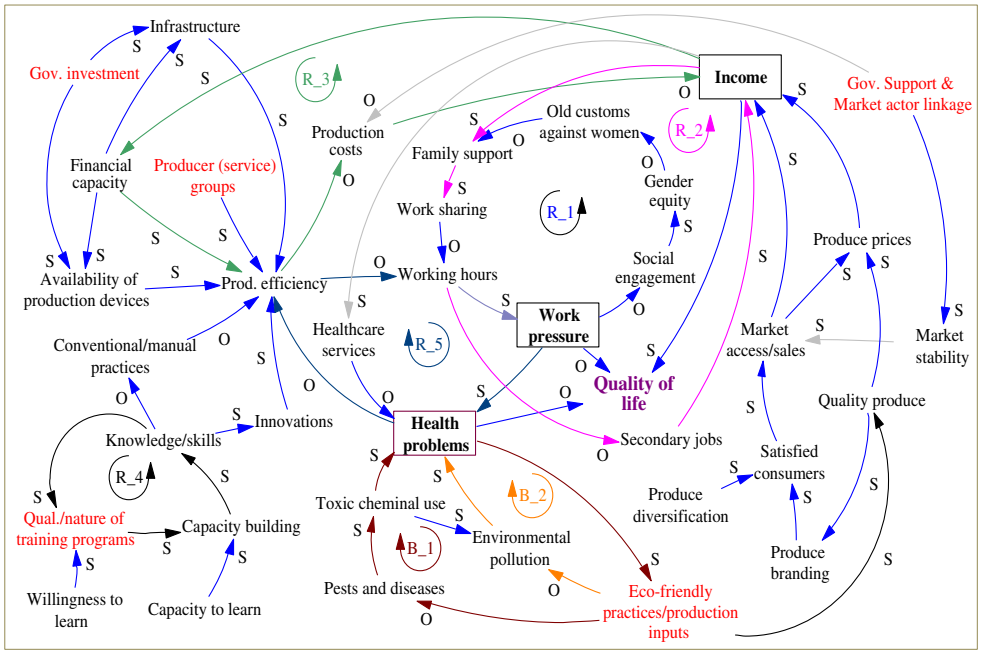

Fig. 4. CLD modelling for improving the quality of life of women small farmers in rural Haiphong. *Legend: S — same direction; O — opposite direction; R — reinforcing (feedback loop); B — Balancing (feedback loop) (Source: adapted from* Ha et al., 2015c*).*

activities, which would further promote gender equity (R6, Fig. 5). The outcomes are consistent with findings of Bosch et al. (2015) and IFAD (2013).

3.3. Comparative analyses of general characteristics of farming systems and factors influencing the quality of life of women farmers in lowland and upland regions

3.3.1. Similar characteristics

First, the rural women and farming households in both regions have to face a number of similar challenges which are *multidimensional*, *interconnected* and related to *multiple stakeholders* such as market actors, service providers, extension networks and local governments. The systems models (Figs. 4 & 5) clearly show that the farmers live and work within a complex web of interdependent subsystems (environmental, political, social, economic and cultural), which are beyond their farming/production systems. For example, Fig. 4 shows that labour hardship of the women in Haiphong is influenced by (1) old customs against women (*cultural factor*) leading to their production and domestic work burdens; and (2) conventional labour intensive production practices (*production system*). To reduce work pressure the stakeholders stated the need for government support (*political factor*) with regards to production infrastructure, access to production implements, regulating input prices, and strengthening the extension network for effective capacity building. In addition, institutional support for local production service groups and cooperatives were found equally important to facilitate work sharing and production efficiency. Forming formal cooperatives via land consolidation on voluntary basis amongst individual farmers was stated as one

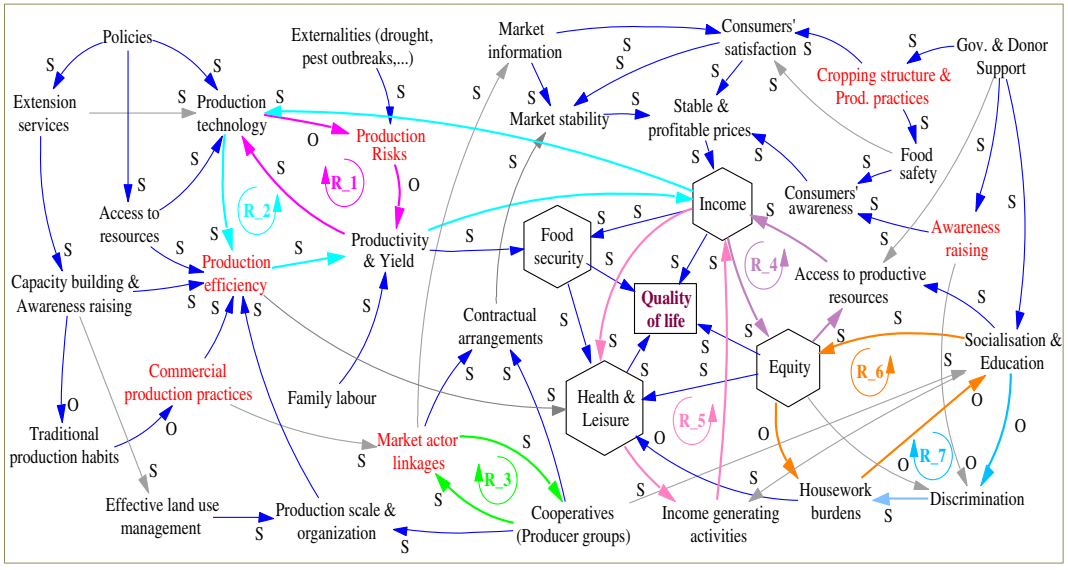

Fig. 5. CLD modelling on improving the quality of life of women small farmers in the NMR. *Notes: S — same direction; O — opposite direction; R — reinforcing (loop). Red coloured variables are potential leverage points for systemic interventions (Source: adapted from* Trinh et al., 2015*).* (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

of the requirements for the success of smallholder agribusiness and thus their income (*economic factor*). The recent baseline survey (Ha et al., 2015b) indicated that conventional unsafe production using toxic chemicals is amongst the contributing factors to polluted environment (*environmental aspect*) and poor health, which influence their production efficiency. Raised income was also reported to have multiple benefits in access to healthcare services and productive resources, improving their status within the family and community (*social factor*), and thus improved family support and work sharing (Fig. 4). Similar nature of interactions between the variables within a subsystem and their interplays with variables of other subsystems is also evident in the upland as indicated in Fig. 5.

Second, *land fragmentation*, *small-scale production systems* and *conventional practices* have also been reported to hinder market access and thereby poor and uncertain income for the farmers in both regions (Ha et al., 2015b; Trinh et al., 2015). For example, the production land areas in rural Haiphong and Phu Tho are 0.31 ha and 0.58 ha per household, respectively (Ha et al., 2015b; Yen et al., 2013). Results are also consistent with findings of various studies in developing countries regarding the barriers to market access of smallholder farmers (e.g. Barrett et al., 2012; Fischer and Qaim, 2012; Hazell, 2005) and findings of Minot and Hill (2007) in the uplands and peri-urban areas of Vietnam.

Third, being smallholder farmers in a poor country, their production is highly dependent on *supporting policies and orientation (political factor) of the central and local governments*. This is similar to the characteristics of smallholder farmers in other developing countries such as those in Sub-Saharan Africa (Bosch et al., 2015). For example, funding and support from the governments for production infrastructure (roads, power grid and irrigation canals), regulation of prices of inputs (e.g. fertilisers, pesticides), capacity building via the extension network, and promotion of market linkages were found essential in the lowland (Fig. 4). Similar aspects of support are also evident in the NMR (Fig. 5). Some slight differences regarding the political factors between the two regions, as well as the requirements that farmers have to address are presented in Subsection 3.3.2.

Finally, the systems dynamic models in the two regions denote several similarities. In both regions, factors such as *changing production practices and organisation, and enhancing market actor linkages* to improve income for the women in particular, rural households and farming communities in broad terms were found to be important. Extensive use of chemical pesticides in both regions (Ha et al., 2015b; Pham and Smith, 2013; Trinh, 2014) could be seen as an implication of unsustainable production systems. It is also a contributing factor to poor quality produce and health of the producers. Additionally, the need for engaging the women in *social activities and capacity building* to improve their status and thus gender equity are also asserted in both regions (Figs. 4 & 5). According to Nghiem (2010), enhancing education levels would improve farmers' livelihood options. However, the authors argue that education would be a long-term objective while the basic needs are being addressed (for example, food security, health and income). A study by Safa (2005) in Yemen showed that education level does not have significant influence on income of smallholder farmers in the highlands, but it has significant impact in the lowlands. Furthermore, a large number of studies has proven that informal capacity building and social engagement for marginalised women could improve their livelihoods and promote gender equity via improved knowledge, social status, decision making power, reduced domestic violence and improved work sharing by men (Bosch et al., 2015; IFAD, 2011, 2013; Lapar et al., 2006; Minot et al., 2006).

3.3.2. Differences between the two regions

Due to the evident differences in regional settings (natural and human aspects), factors influencing the livelihoods of women smallholder farmers in the two locations also have distinctively different characteristics.

As discussed, having a number of similarities regarding their multidimensional challenges as being smallholder farmers under the same political system, the women farmers in the two regions have rather distinctive nuances due to both human factors and regional settings. These lead to the significant differences in terms of their prioritized needs and what they regard as the main determinants of their quality of life.

The women in NMR have to face more challenging issues due to a number of reasons. Those include unfavourable biophysical conditions, further away from markets, lack of information, conventional subsistence production habits, language barriers, high level of gender-bias conception against women as well as inappropriate supporting policies. Therefore, the multiple issues could only be addressed by a more holistic approach and coordinated actions rather than the traditional "piecemeal" approach. A complete process towards defining systemic interventions and developing an overall integrated management plan as presented in Ha et al. (2015c) could be applied in the NMR as well to help address the multidimensional problems that the women farmers are facing.

4. Conclusion

This study provided in-depth insights to the current situations of women farmers in the two regions. Though having some similarities, the regional differences in terms of geographical, natural and human factors reveal a more vulnerable situation of the women farmers in the NMR. This study has also highlighted potential levers for systemic interventions to address their respective challenges.

The interrelationships amongst different factors in the two systems models suggest a need for engaging relevant stakeholders in the problem structuring and decision making processes. This will ensure the provision of more practical and rational policy recommendations for coordinated actions to improve the lives of the women farmers in the two regions.

It became clear that solving specific challenges of the women smallholder farmers in both regions requires a holistic view to analyse the situation in more depth for adequate interventions. This is because they are part of and influenced by bigger systems (rural households and farming communities) and their complexity where various factors (biophysical, social, economic, political and cultural) are intertwined. It is important that this must be taken into consideration for appropriate approaches and interventions in each specific locality.

This study provides both theoretical and practical contributions in agricultural systems research and development. It introduces a new approach and systems tools in dealing with complex problems of agricultural systems in the studied contexts. Given the generic nature of the approach and process steps, the systems approach and tools can be applied to solve complex problems in other contexts around the world. This study has proven that the traditional top-down and/or supply-driven approach is clearly inappropriate, which does not address the real needs of local people and thus not lead to sustainable outcomes. The traditional approach tends to solve immediate problems such as labour hardship, while it ignores the fact that the lives of the women farmers are influenced by various factors beyond their production systems. The study addresses the drawbacks of a so called "silo thinking" in many development efforts in Vietnam as pointed out by a number of authors (e.g. Bosch et al., 2013; Culas, 2012; Paris and Chi, 2005). The systems approach also helps to visualise areas of interventions within the systems that need to engage relevant stakeholders for coordinated actions towards sustainable outcomes.

Further research is recommended that will focus on market actor linkages for improved market access and development of systemic management plans for improving the quality of life of the women smallholder farmers in NMR.

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CHAPTER 5: PRACTICAL CONTRIBUTIONS OF THE SYSTEMS BASED EVOLUTIONARY LEARNING LABORATORY TO KNOWLEDGE AND STAKEHOLDER MANAGEMENT

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Contribution to the Paper	Designed and performed data analysis and interpretation, wrote manuscript, and acted as corresponding author.		
Overall percentage (%)	85%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	15 July 2016

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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CHAPTER 6: SYNTHESIS AND CONCLUSION

6.1. OVERALL CONCLUSIONS

This study has shed light on the validity of the holistic (systems) approach in dealing with complex situations under interwoven relationships of various human, economic and natural factors. The top-down "problem-solving" approach with a traditional linear vision is clearly no longer appropriate to address the complexity of the "complex web of lives" of the women smallholder farmers in rural settings. The ELLab offers clear guided steps to unravel fuzzy problems and identify their real needs, interrelationships among factors and importantly to identify the root causes of visible problems. In contrast with the conventional "problem-solving" approach through identifying immediate solutions to a pre-defined and/or perceived problem, the ELLab can be seen as a new tool to be added in the "toolbox" of "problem-structuring and solving methods" for researchers and practitioners in community development and other areas around the world.

Even though labour hardship is amongst the various challenges that the women farmers face, it is just a "visible" result of their interrelated economic, social and cultural constraints. Lack of a systems analysis in defining interventions would certainly lead to unsustainable outcomes due to the "interconnectedness" of various factors that influence their lives. In addition, women farmers are just part of rural households, farming communities and agricultural systems. Analyses of these hierarchical systems serve as a rational foundation for developing and understanding the "bigger picture" of the context surrounding the issues and target groups under consideration for adequate systemic interventions that will have long-lasting effects on the lives of the women farmers.

By employing the systems-based ELLab with its built-in user-friendly systems tools, implementing the identified systemic interventions (Chapter 3) to address their real needs (improving income, reduce work pressure and improve health) will not only solve the "visible problem", but also bring about an overall improvement of their quality of life. This would be in line with the broader aim of many community development efforts (e.g. Emery *et al.*, 2006; Gutierrez-Montes *et al.*, 2009a; Murphy *et al.*, 2009), rather than "piecemeal" approaches in solving issues in isolation.

Although integrated governance using a holistic systems approach is important at the local government level (Nguyen *et al.*, 2014), the same approach should be adopted and embraced at a community level. This is because community issues are also complex, involving multiple-stakeholders, and are influenced by various factors (natural, economic, social, environmental, political and cultural).

Addressing the aim and objectives of this study has also helped to explore and compare typical characteristics of women smallholder farmers, their determinants of quality of life and bigger pictures of farming systems in two subregions, lowland and upland, of northern Vietnam (Chapter 4). Results of this study would provide important insights for future studies and interventions towards a comprehensive improvement of their lives in particular and effectiveness of farming systems in more broad terms.

This study has developed and embraced a number of important frameworks in supporting research and development in the fields of community development and project management. These include traditional problem solving (Ha *et al.*, 2015b) to avoid "quick fixes" and informing adequate development policies, integrated systemic management planning (Ha *et al.*, 2015c), stakeholder mapping tool, logical framework for project management (Ha *et al.*, 2015a), transformative learning, knowledge creation (Ha *et al.*, 2015e), and mechanism for sharing knowledge and experience at both local and global levels (Bosch *et al.*, 2015; Ha *et al.*, 2015f). The generic ELLab framework, which allows the flexible use of relevant management tools, has helped to address emerging problems during project planning and implementation. The systems approach and especially the ELLab framework are generic of nature and can certainly be used successfully in any other context, target group or area of interest on a global scale.

6.2. REVIEW OF THE RESEARCH OBJECTIVES

This section starts from reviewing the developed hypothesis that "*Complex issues such as finding economically viable, environmentally friendly, culturally acceptable and socially appropriate solutions cannot be addressed through traditional linear thinking that normally leads to quick fixes/treating of the symptoms. They require a systems approach for defining long-lasting (sustainable) solutions*". This study has clearly proven that the issues faced by the women smallholder farmers are highly complex and interwoven in relationships of various economic, environmental, cultural, social and natural factors (Ha *et al.*, 2016). As

mentioned, finding solutions isolated from the whole to address their perceived labour hardship cannot yield sustainable outcomes (Ha *et al.*, 2015b, 2015c). Although the developed solutions based on the traditional linear approach were important to provide general guidance for interventions and a basis for the systems analyses (Ha *et al.*, 2015b), they failed to recognise the interrelationships among factors and future impacts of the proposed interventions (Ha *et al.*, 2015c). In contrast, the systems approach through the use of the ELLab framework with its built-in systems tools can address these drawbacks. Following the ELLab steps and acknowledging the flexibility to include other methods that can add value, have enabled the research team and participants to understand the interrelationships among various factors and stakeholders involved and to develop a systems model (big picture) of the context in which the women are facing their "hardship" (visible) problem. Testing of future scenarios enabled a projection of possible future impacts and consequences. The expected outcomes were not only for reducing their labour hardship, but improving their quality of life as a whole.

The developed solutions targeted the real needs of the women farmers by embracing a participatory bottom-up approach that took into account the inputs and suggestions from relevant stakeholders under the current socioeconomic, cultural and environmental setting. The appropriateness and practicality of both the approach and developed interventions were acknowledged by the women farmers and local partner organisations. Particularly, a leader of the Department of Agriculture and Rural Development stated to use the developed solutions into their annual operational plan in supporting the marginalised farmers (Bosch *et al.*, 2016; Ha *et al.*, 2015a). This can be regarded as evidence that the overall objective of this study has been achieved.

In addition, achievements of all the five specific objectives were discussed in detail in Chapter 3. These are part of the 7-step systems-based ELLab framework. It started from gathering and sharing mental models of the participants for mutual understanding among stakeholders about the production systems, labour use and challenges the women are facing (Objective 1). Engaging key representatives of the target groups and stakeholders throughout the process was proven as an effective way to build capacity of participants, because they became continually involved (Objective 2). Given capacity building can take many forms, either formal or informal (Bosch *et al.*, 2014a; Ha, 2014; Le & Ha, 2016), informal learning and learning by doing by community members who have limited knowledge of systems

approaches, were essential to build their understanding of the basic concepts of systems thinking and causal relationships. Their active role in defining such relationships and taking into account that all the components are intrinsically interlinked, provide excellent evidence of the fact that "learning by doing" (with no formal capacity building) has been highly successful. These insights enabled the participants to develop a systems model for a shared understanding of the current situation under which they operate (Objective 3). The model and their understanding of interconnectedness also served as the basis for identifying leverage points and systemic interventions (Objective 4) and developing a systemic management plan (Objective 5). The developed plan clearly reflected how their real needs can be addressed and areas of interventions that require involvement of relevant stakeholders in supporting the marginalized farmers. The plan did not only show how the labour issue can be solved, but also indicate how other interventions can be combined for synergic efforts to improve their overall quality of life.

6.3. LESSONS LEARNED

The study has elucidated a number of valuable lessons learned for future research and practical applications of systems approaches in other contexts.

To avoid initiating "quick fixes" in addressing a problem as commonly practiced by the traditional reductionist approach (Adams & Cavana, 2009; Bosch *et al.*, 2007; Bosch *et al.*, 2014a; Maani, 2013; Sterman, 2001; Vester, 2007), an in-depth analysis is required to ***understand the context*** surrounding an issue under consideration as well as the importance of ***stakeholder involvement,*** especially during the issue identification step. Participatory approaches enable voices of the beneficiaries and relevant stakeholders to be heard and acknowledged. This will not only guarantee the formulation of appropriate context-based interventions, but also enhance acceptance for implementation. This is in accord with findings of Murphy *et al.* (2009) and Ha (2014) in other community development settings in developing countries and Vietnam, respectively. Thus, the developed solutions are locally-based and are therefore appropriate, in contrast with the traditional top-down approach which has been heavily criticised (Ha *et al.*, 2015c; Russell & Ison, 2000).

Capacity building is part of the overall efforts towards sustainable development and community resilience (Le & Ha, 2016). As mentioned above, the informal capacity building activity used in this study helped to empower the target group and local counterparts. This

laid a strong foundation for active participation, taking ownership of the process and outcomes. Training of Trainers (ToT) and learning by doing activities of key members together with full participation of relevant stakeholders throughout the problem structuring, planning and decision making processes clearly promoted co-learning and accountability towards joint actions. This is consistent with findings of Maani (2007, 2013). True participation is essential to achieve the sense of ownership (Stein & Imel, 2002) and thereby sustainable outcomes (Nguyen *et al.*, 2011). According to Bosch *et al.* (2014b) and Le and Ha (2016), building capacity is important to develop "capacity for change" among individual learners. Additionally, it triggers changes of perceptions and thus actions of local people, improving understanding of their own local settings, capacity to influence others, and removal of social barriers (Bosch *et al.*, 2015). Capacity building (Step 2) can be a way to enhance participants' confidence and self-directed learning (Yorks & Kasl, 2002). More importantly, enhanced capacity can lead to grass-root initiatives and innovative practices that would in turn help local people to drive sustainable community development (Middlemiss & Parrish, 2010).

Various studies in developing countries, including Vietnam, have shown many positive impacts of improved income and knowledge for rural women, such as an increase in production efficiency (Castella *et al.*, 2006; Rahman, 2003; Wegner & Zwart, 2011), independency (Lapar *et al.*, 2006) and the social status of women in the societies they are part of (IFAD, 2011, 2013; Lapar *et al.*, 2006). In this study, due to the "systems effects" (Ha *et al.*, 2015g), ***improving income and capacity for the women farmers*** would most likely lead to success in improving their health and social status through reducing their workload of domestic and production tasks. Their free time derived from enhanced production efficiency could be spent on other income generation activities, which in turn further improves their financial power. This would lead to improved family support, sharing of work tasks and social engagement. Therefore, their voice would be raised and cultural barriers (old customs and/or traditional taboos against women) would be gradually removed.

Improving production efficiency *and* ***market access*** are essential to the success of small-scale agribusiness and therefore more secure income and savings for the women farmers. This will certainly generate positive impacts on their capability and social status. However, more organised production among individual farmers is required through forming "formal" cooperatives to enable stronger market actor linkages and meeting market requirements in

terms of consistent quality, volume and delivery time (Ha *et al.*, 2015d). Interestingly, local organizations, particularly women unions and farmer associations, play an important role in facilitating both increased production and more social engagement for rural women (Ha *et al.*, 2015b). Mobilising these organizations (social capital) would trigger the process of life quality improvement in various aspects. The approach might be explored and adopted in other contexts with similar problems in the developing world.

Additionally, by actively participating in the learning and action process (see Figure 7 of Chapter 5), the participants' mental models are shared and transformed. This can be regarded as "***transformative learning***". Senge and Sterman (1992) contend that a mental model is modified overtime, even via mere dialogue. Mental models might be considered as the individuals' "frames of reference", i.e. "meaning perspectives", "habits of mind" and/or "mindsets". Transformational learning occurs when the "frames of reference" are transformed into ones that are more comprehensive, open and reflective to induce more factual and justifiable beliefs and opinions, leading to appropriate actions (Mezirow, 2000). Besides, group work can combine and align individuals' mental models into a comprehensive view of the entire system (Maani, 2007).

Knowledge is gained through personal experience, while the latter is consolidated by four common modes of knowing, namely, experimental, presentational, propositional and practical (Yorks & Kasl, 2002). The ELLab framework would provide an excellent platform (an "***experimental lab***") where the knowledge and experiences of participants are shared and improved. Furthermore, the ELLab, with the practices of "group thinking" (Nguyen *et al.*, 2011) and "group model building" (Maani, 2007), meets the needs of participating stakeholders since adults prefer "learning by doing" (Machin & Creed, 1999). Maani (2013) argued that the learning lab helps participants develop a capability for systems thinking and modelling, joint learnings, development of mutual trust and readiness for open sharing.

Reflection brings about two positive benefits. At the personal level for individual participants, regular reflection is crucial to validate their notions (Yorks & Kasl, 2002). According to McGill & Beaty (2001), a new way of sense-making and understanding can be derived from reflection. For groups, reflection provokes lessons learned, shared experiences and continuous co-learning (Bosch *et al.*, 2013b).

The ELLab can be seen as a similar ***learning cycle*** as described by Maani & Canava (2007). However, it seems that the latter simply describes the learning, action and reflection process generally without any specific guidelines. The ELLab was actually developed from the biosphere learning laboratory process (Maani 2011, cited in Maani, 2013). Nonetheless, the ELLab emphasizes the importance of the ***"evolutionary nature" of knowledge building*** and provides the directions for sharing experiences that leads to improved levels of learning and performance at both local and global levels (Bosch *et al.*, 2015).

By comparing the ELLab with other frameworks such as action research (Coughlan & Coghlan, 2002) and adaptive management (Bosch *et al.*, 2004), it has an evident strength thanks to its ***integration of systems tools***, in which systemic interventions (solutions) can be tested for impact evaluations, rather than "trial and error".

The systems-based ELLab can be seen as an effective framework with logical and complete steps to unravel complexity and uncertainty in managing complex and wicked problems. The systems approach and framework have helped to explore a large number of important aspects with in-depth insights for future research and development. These include preconditions for agribusiness success of small-scale agricultural systems (Ha *et al.*, 2015d), community development (Ha *et al.*, 2015g), project management (Ha *et al.*, 2015e), agricultural systems research (Ha *et al.*, 2016), operational research (Bosch *et al.*, 2016), and action research (Ha *et al.*, 2015e, 2015f).

As said, the ELLab embraces ***true participation*** of the target group and stakeholders. By referring to the levels of community participation (Figure 6.1), it would be argued that this study has reached Level 3 (Partnership). That is, community members and developers and/or facilitators make decisions about outcomes together. This is because of two main reasons. First, the study just underwent the first five steps of the ELLab. Second and more important, the research team did not receive funding for the implementation phase. Only when the participants (community members) have opportunities to implement and reflect on the implemented activities through the ELLab, their capacity would be substantially improved. These will enable them to make decisions and control outcomes independently (Level 4 – Self-determination). This would require several cycles of (systemic) actions and reflections in accordance with the ELLab capacity building component.

Levels of participation	Description
4- Self-determination	Community members make decisions and control the outcomes.
3- Partnership	Community members and development organisations make decisions about outcomes together.
2- Consultation	Development organisations make the decisions, but community members have some influence.
1- Manipulation	Community members have no say but their presence is used to justify or promote others' agendas.

Figure 6. 1 - Levels of community participation

(Source: adapted from Eversole, 2014).

The above figure also implies that the supply-driven and/or expert-led approach is no longer appropriate. Only true participation together with building capacity for community members can lead to sustainable outcomes and long-term impact.

6.4. THEORETICAL CONTRIBUTIONS

This study has achieved a number of important contributions to the field of knowledge. First, the ELLab can be seen as an innovative and effective "***problem-structuring method***" (PSM) in dealing with complex and ill-defined problems across contexts, particularly in the field of community operational research (Bosch *et al.*, 2016). This should be added to the existing "toolbox" of PSMs as listed by von Winterfeldt and Fasolo (2009). According to these authors, "all PSMs aim to support groups confronted with problems involving multiple actors, multiple conflicting perspectives and key uncertainties"… and these methods "share the ability to model the problem situation so that people involved are clearer about the issues at stake, and can converge on, or commit to, a potentially actionable set of priorities". This is to contrast with the conventional "problem-solving method" that starts from identifying solutions to an already-defined problem (Rosenhead, 1989). The PSMs allow greater understanding of issues before determining adequate interventions (Foote *et al.*, 2007).

The study has addressed an important current ***knowledge gap*** in terms of ***community operational research*** **(COR)** in developing countries. White *et al.* (2011) argue that COR

would be helpful to address many issues in the less developed countries towards achieving the Millennium Development Goals. However, few have been conducted in these countries. Areas of applications include agriculture, health and empowerment of women through developing self-help groups, etc. Nonetheless, little attention was paid to the interactions amongst the issues, especially in rural areas (White *et al.*, 2011; White, 1994). Additionally, Friend (2004) outlines five challenges in decision making. Those include examining structural links among issues; developing feasible and acceptable solutions; resolving possible conflicting interests and goals; projecting consequences of developed actions; and addressing uncertainties. This author argues that there are a few methods that can address all the difficulties at the same time. The systems-based ELLab employed in this study with its complete steps could be regarded as a problem structuring tool to help address all five of these difficulties. The structural links among issues in accordance with concerns and needs of different actors can be captured and acknowledged through developing the "big picture" (systems model) of the current situation. The solutions developed from this study are locally-based through the participative processes and thus feasible and acceptable. Through the aid of a decision support tool (Norsys, 2013), future consequences and uncertainties could be projected. Therefore, the ELLab could be seen as an effective problem structuring methodology in dealing with such challenges.

In addition, this study has explored its applicability in embracing systems approaches in development fields and ***addressing current drawbacks of other methodologies***. Even though the Community Capitals Framework (CCF) has recently been proven as an effective holistic tool used in agriculture and community development (e.g. Emery *et al.*, 2006; Flora *et al.*, 2012; Flora & Thiboumery, 2005; Gutierrez-Montes *et al.*, 2009a; Gutierrez-Montes *et al.*, 2009b), strategic actions developed based on the capitals are overlapped (Ha *et al.*, 2015g). With the aid of systems tools, the authors have pointed out that the two built-in tools of the ELLab (Vensim® and Netica™) can be of help to address this drawback through combining strategic actions and defining levers for systemic interventions for development of an integrated management plan (Figure 6.2). These would guide future research to integrate systems tools for effective planning, while saving time and resources.

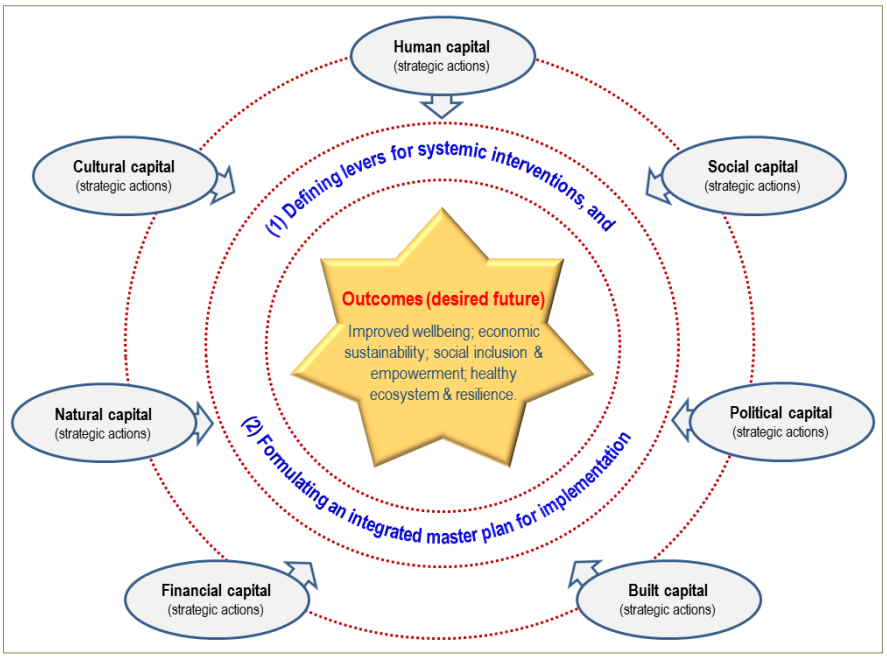

Figure 6. 2 - Combining proposed strategic actions to develop an integrated master plan to solve fuzzy problems for achieving the desired sustainable communities

(Source: Ha *et al.*, 2015g).

This research has significantly contributed to ***organisational learning theory*** (Argote, 2013; Fiol & Lyles, 1985) through reflective changes in perception and thus subsequent actions among the stakeholders. The study has developed important frameworks to visualize how tacit knowledge of participants are captured, shared and transformed to becoming accessible for co-learning and actions through the ELLab socialized setting (Chapter 5). The occurrence of transformative learning started from a personal level among participating members to an organizational level through the plan of action by the primary local partner department in supporting the target group (Ha *et al.*, 2015a). The study also filled the gap as stated by Taylor (2007) with regard to in-depth insights of ***transformative learning process*** and how people amend their worldviews through the co-creation of knowledge and co-learning processes. The systems-based ELLab can also be regarded as an effective tool that trigger participatory action research (Ha *et al.*, 2015f).

In addition to the transformative learning framework developed in Chapter 5, the following organizational learning framework (Figure 6.3) was formulated to explain how new levels of learning and performance can be obtained among diverse stakeholders at both local and global levels through the newly developed Think2Impact global knowledge hub. Their sharing of reflections will help generate new knowledge and insights to different approaches in dealing with a certain issue of shared interest on a global level.

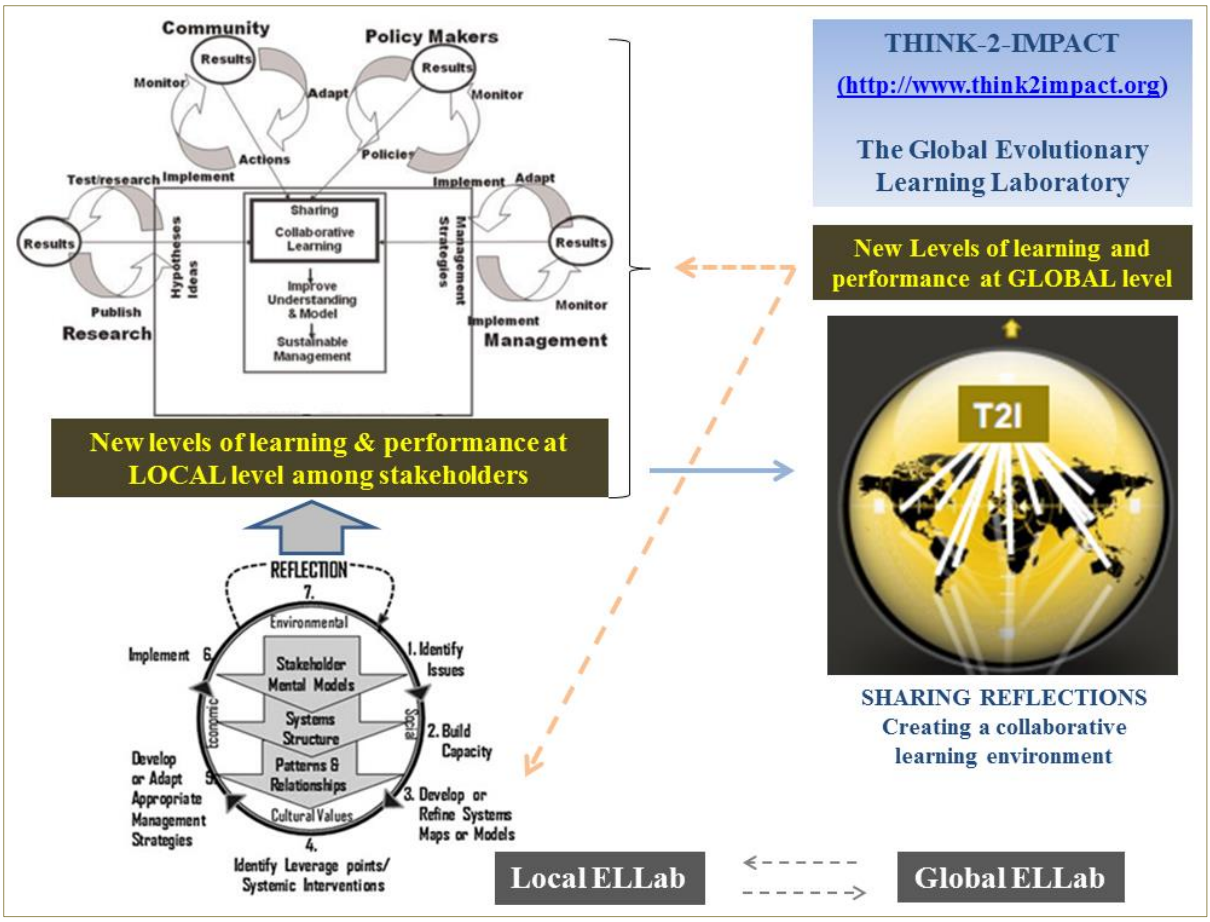

Figure 6. 3 - New levels of learning and performance among stakeholders at local and global levels from an adaptive management perspective

(Modified from Bosch *et al.*, 2004; Bosch *et al.*, 2013b; Nguyen *et al.*, 2011).

Finally, the study has substantially contributed ***stakeholder and knowledge management*** in the field of project management. It further embraces the "*Actor – Network Theory*" in relation to project stakeholder management (Missonier & Loufrani-Fedida, 2014) as it emphasizes the *dynamic* and *emergent* nature of stakeholder networks. Therefore, continuous analyses and engagement of actors in all phases of a project are required (Achterkamp & Vos, 2008; El-Gohary *et al.*, 2006). The conventional "plan-then-execute" approach has been proven no longer appropriate through this case study. It further confirmed that project management is rather a "journey of knowledge creation" (Chapter 5). The flexibility of this project approach has enabled the engagement of the right stakeholders, who not only ensure collecting relevant information, but also make it possible to reframe the project goal (in order to, in the case of this study, address the real needs of local people).

6.5. PRACTICAL IMPLICATIONS

First, the newly developed ***generic framework for structuring and solving problems*** (e.g., sustainable development, education, governance, child safety, business development, complex project delivery, poverty reduction, etc.) (Bosch *et al.*, 2013b), the ELLab has further proven to be an effective methodology for addressing fuzzy problems and uncertainties in cross-sectoral contexts. In this study, as analysed in the previous section, labour constraints were considered as the perceived problem (visible problem) to be solved. The ELLab helped policy makers, managers, developers and relevant stakeholders to understand, through the systems based-approach in problem solving, that this was only a symptom of a much bigger problem, namely the interconnectedness of the perceived problem with many other factors that affect the quality of life of the women farmers. Focusing only on the issue of hardship would not have helped to solve this problem, because "cause and effect are not close in time and space. Obvious solutions could produce more harm than good, and short-term fixes produce long-term problems" (Senge, 1990). The intension of the ELLab is not to train any target group and relevant stakeholders in the use of the systems tools, but rather build their capacity to understand causal relationships among factors surrounding the issue of concern and to involve the relevant stakeholders in predicting and monitoring the potential future impacts of their decisions. Through the co-learning environment, the participants can together define the most feasible and appropriate interventions. Moreover, thanks to ***the nature of continuous reflections and joint learning***, continuing this study (steps 6 and 7) could serve as a case study contributing new knowledge and shared experiences towards improved performance at a global scale through the newly developed Think2Impact^{TM} global knowledge hub.

Evidence from this study is of invaluable importance to ***change the mindset of donors as well as developers*** around the world to move away from "piecemeal" and supply-driven approaches in supporting disadvantaged and marginalised groups. Funding bodies and philanthropists often focus on quick fixes – solutions that may rapid show results, but do not last in the long-term. Sustainable outcomes can only be achieved when *true participation* is facilitated for local people to define their real needs and decide their own futures.

Application of the ELLab in this study, especially if implemented in follow-up research to institutionalise the ELLab, has great potential to produce some ***positive social impacts*** for the region under examination and for the country as a whole. At the national level, reducing the

labour burden for rural women and thus improving their quality of life would contribute to gender equality in the society, gearing towards "growth with equity" as stated in the national development strategies (Cuong, 2011; Fritzen, 2002). This research would also assist improving the rural life in Haiphong province, while formulating context-based recommendations for funding agencies and local governments.

The approach employed in this study has helped to address current challenges and drawbacks in agricultural systems research and development in Vietnam. The lack of a holistic approach in many agricultural development projects in Vietnam has been reported to induce failures (Culas, 2012; Paris & Chi, 2005; Vien, 2003; Vien *et al.*, 2006). A few of those focus on "socio-agricultural dynamics and changes" (Culas, 2012). This study fills the gap through the practical ELLab process that enable the "***inclusiveness***" of not only all relevant stakeholders, but also a holistic view on hierarchical systems relationships (*i.e. women farmers, rural households and farming community*), and different dimensions of sustainable development (i.e. *economic, environmental, social and cultural*).

Last but not least, Ngo & Pham (2008) recognised a number of challenges in community development in Vietnam. In which, complicated methods and tools were found to be one of the major bottlenecks. Furthermore, Murphy et al. (2009) recommended a number of comprehensive approaches towards a more "appropriate technology" and considerations for adoption. However, the procedures and tools to solve the problems were not clearly presented. In this study, the ELLab provides ***simple guided steps and tools*** to guide participants in problem structuring and decision making processes. Additionally, its built-in capacity building component enables local people to take ownership of the process and therefore sustainable outcomes. What's more, as a generic framework it enable a high degree of flexibility to incorporate other management tools to improve the effectiveness of the ELLab process. For instance, the stakeholder mapping tool was integrated in Step 1 to help identify the right stakeholders in understanding the current situation, the real needs of local people – which led to a reframing the project goal, that was originally formulated by the funding body of this research (Ha *et al.*, 2015a).

6.6. LIMITATIONS OF THIS STUDY

As discussed above, there are many obvious advantages when applying the ELLab process for dealing with complex issues. There are, however, two main drawbacks. First, executing

systemic interventions for treating the root causes of the issue under consideration would take a relatively long time for the outcomes to be evident. This would hinder the allocation of funding to address the issues. This is probably one of the reasons why long-term research is difficult to get funding for. Funding bodies and financial aid from countries may want to see "quick results" to show what has been done and how their funding has been used to create tangible outcomes (e.g. a bridge, a medical clinic, etc.), because governments normally do not stay in power long enough to engage in projects that will take longer than their period of governance. Similarly, foundations and philanthropists may also want to "show" the outcomes of their donations quickly. That is, quick fixes and treating the symptoms remain the favourite type of projects that they would fund.

Second, the separate structures and functioning within each sector or among departments have been seen as a habitual way of thinking and operation that might impede cross-sectoral collaboration (Bosch *et al.*, 2013b). Additionally, personal perception may not be easily changed immediately, but it may take several months to years through a number of action and reflection cycles (Ha, 2014; Yorks & Kasl, 2002) to develop a "new way of thinking". That is, any societal change would be very difficult to happen overnight. To address this, some successful pilot showcases of ELLab adoption in governance and sustainable development has been undertaken in recent years in Haiphong, Vietnam by Bosch et al. (2013a). Recent studies using systems approaches in other areas have also been undertaken in other areas around the world (e.g. Banson *et al.*, 2014; Bosch *et al.*, 2014a; Ha & Le, 2016; Kiura *et al.*, 2014; Nguyen *et al.*, 2014; Trinh *et al.*, 2015). These studies could provide "stock of evident successes" as the leverage for raising awareness of a "new way of thinking" and subsequently wider application. In addition, continuous support of local leaders ("champions") is of crucial importance to ensure effective performance and for the ELLab to become institutionalised (Bosch *et al.*, 2013b).

In terms of software, the feedback loops in causal loop diagrams cannot be represented in Bayesian Belief Network (BBN) modelling that could somewhat influence modelling results. Nonetheless, the intension is not to identify feedback loops in the BBN modelling, but rather to reveal the causal influences of all factors within the system on achievement of the final goal.

Due to a limitation of time for the PhD candidature, steps 6 and 7 of the ELLab were not implemented. Therefore, the success of implementation and practical outcomes of reflection

on implemented systemic interventions were not achieved. Yet, initial reflections on the planning phase have gained important insights and lessons for policy makers, donors, researchers, practitioners, local governments, partners and beneficiaries in terms of its approach and initial successes that have changed perceptions and readiness to integrate the identified interventions into the operational plans of the key local partners (Ha *et al.*, 2014).

6.7. FUTURE RESEARCH

This study has highlighted important insights and guidance for a number of future research directions below.

- Research that apply the entire process of the seven-step ELLab in similar contexts and link to the global Think2Impact^{TM} knowledge hub for lessons learned and sharing reflections for improved performance of similar studies and projects around the world;
- Enriching "stock of evidence" by applying more holistic approaches and systems tools in agricultural systems and community research and development to change perceptions of policy makers and donors in ensuring relevant support for the rural poor and other marginalised groups;
- Establishing typical systems archetypes in agriculture and community development to inform policies and raise public awareness;
- Relations between improved capacity of women farmers and their decision making power, removal of cultural barriers and social inclusion;
- More research into proving the evident role of "collective actions" through organised groups and stakeholder collaboration in enhancing power and social status of women farmers;
- Institutional strengthening of local producer groups (cooperatives) and market actor linkages for improved market access and income of women smallholder farmers;
- Mapping and mobilisation of local and potential resources for improving the quality of life of women farmers.

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