



# 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.

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## 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; Kabere, 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 socio-cultural, 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; Lamprinoupolou et al., 2014; Macadam and Packham, 1989; Mainland, 1994; Paracchini et al., 2015). However, so far no study has

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