Understanding the long-term strategies of vulnerable small-scale farmers dealing with markets’ uncertainty

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In this paper, we present a framework and a methodology to identify the long-term strategies of small-scale farmers dealing with uncertainties. To do so, we link the Activity System framework to the concept of perceived vulnerability and analyse the small-scale farmers’ trajectories. Based on a sample of 34 small-scale coffee producers in Guatemala and through the analysis of case studies and classification methods, we identify some trends in long-term decisionmaking. These trends are mainly built on responsiveness, autonomy, vulnerability shifts and collective means of action. We finally discuss these findings in the light of previous studies carried out in different contexts.

KEY WORDS: long-term strategies, perceived vulnerability, Activity System, smallholder, Central America, Guatemala

Introduction

Commercial agriculture, by its nature, implies environmental and market uncertainty. Perennial crops commonly flourish where the uncertainty is moderate – given the long-term investment required – and where farmers have enough resources to withstand short-term unfavourable conditions (shocks). Environmental and market uncertainties are increasing and are affecting more strongly small-scale perennial farmers with little capacity to buffer disrupting events. This is particularly true in countries like Guatemala where there is hardly any technical and economic support for small-scale agriculture and no governmental social security for farmers.

In Guatemala, coffee has been the main export crop since the mid-nineteenth century (Gudmundson 1994). Beginning in the late 1950s, small-scale farmers started to cultivate more coffee in the country, thanks to the development of cooperatives promoted by the revolutionary government between 1945 and 1954 (Palma Murga 2008). While this transformation led to a process of emancipation of these farmers from large-scale landholders, marginalised farmers became increasingly involved with one of the world’s
most volatile agricultural markets (Ponte 2002), characterised by intense cyclical crises and a tendency towards lowered prices, taking inflation into account, over the past 50 years (Friedenberg et al. 2004). In other words, small-scale farmers shifted from a dependency on large-scale landholders to a dependency on fluctuating international markets. Thus, this new dependency on fluctuating prices has translated directly into a potential risk of severe vulnerability for small-scale coffee producers.

Here, we refer to vulnerability as a conceptual construction used by researchers to describe a given situation. This concept is partly based on ‘objective’ facts such as the scarcity and/or lack of access to resources (for example land, road infrastructure, social security, public support to agriculture etc.). However, beyond this ‘objective’ vulnerability (as defined by external observers) there is the perceived vulnerability (PV) of farmers themselves, based on subjective perceptions leading to a wide range of strategies to deal with uncertainty. We consider Vultur’s proposal (2010) regarding socially defined precariousness and perceived precariousness by the actors involved. This calls for an understanding of the farmers’ perception of vulnerability and their decisionmaking processes in the long term.

While the strategies developed in response to sudden coffee-market shocks have been studied extensively (see as examples, IDB et al. 2002; Eakin et al. 2006; Watson and Achinelli 2008; Bathfield et al. 2013), strategies implemented by producers to maintain themselves in the long run have not been studied yet (at least not explicitly). In this article, we are thus searching for, identifying, and analysing the long-term decisionmaking by small-scale farmers in the context of uncertainty.

Given the novelty of the approach, we first need to build a consistent conceptual and methodological framework. Drawing on the concept of the Activity System, which focuses on producers’ decisionmaking, we first describe how to integrate into its framework the concepts of (1) long-term strategies for dealing with uncertainty (LSDUs) and (2) PV. We then describe our work with 34 coffee and honey producers in two municipalities of the Guatemalan Highlands, and explain our methods of data gathering and analysis. We identify farmers’ LSDUs and analyse them in terms of their PV. We finally discuss these findings through the light of previous studies carried out in a variety of different contexts.

Long-term decisionmaking in situations of uncertainty

In this section, we briefly describe farmers’ Activity Systems (Gasselin et al. 2012) as a framework to apprehend their decisionmaking. Within this framework, we then establish the relationship between farmers’ PV and their LSDUs.

Framework for the logic of decisionmaking: the Activity System

According to Paul et al. (1994), merely observing agricultural activities does not allow us to understand the logic of small-scale coffee and honey producers’ decisionmaking. These authors consider that these activities occur within a broader life project which often encompasses non-agricultural activities. In an effort to generalise the concept, Gasselin et al. (2012) define the Activity System as an interacting structured set of activities implemented by a social entity which makes use of available resources in a given agroecological and socioeconomic context. In this article we limit our interpretation of ‘activity’ to economical and production activities.

At the farm level, decisionmaking is thus carried out as a function of individuals’ perceptions of their current and long-term situation (their resources, environment etc.) in the process of attempting to satisfy their motivations (Farmar-Bowers and Lane 2009).

Perceived vulnerability

Individuals’ decisionmaking thus depends on their perception of their environment. In the Activity Systems framework, individuals build a mental representation of the opportunities and/or threats which may or may not allow them to satisfy their motivations. These may be referred to as the individuals’ PV (Povel 2010). In other words, PV is the individuals’ perception of the odds of not satisfying their motivations.

In a manner similar to that of vulnerability as defined by Polsky et al. (2007), PV may be divided into three dimensions: exposure, sensitivity and adaptive capacity. We thus conceive of PV as a property of Activity Systems: PV results from the interactions among individuals’ perceptions of their exposure, sensitivity, and capacity for adaptation (Tsui-Auch and Moellering 2010) in an uncertain context. In this paper, exposure refers to the chance that the Activity System will be affected by a given level of disturbance; while sensitivity refers to the degree to which the system is affected, and adaptive capacity is the system’s ability to reduce (1) its exposure, by anticipating – or not anticipating – possible disturbances, and/or (2) its sensitivity, by responding – or not responding – to disturbances. As a consequence, PV increases directly with perceived exposure and/or perceived sensitivity, and diminishes with perceived adaptive capacity.

This framework leads us to consider that coffee producers live through alternating periods (as suggested by Holmes et al. 2007): (1) when disturbance is a possibility and (2) when disturbance is a reality:
1. When disturbance is a possibility, individuals make changes (or don’t) in their Activity System to buffer or take advantage of the possible disturbance according to their perceived exposure. These changes thus reveal a level of anticipation (Billaud 2013): farmers who realise these changes are considered as anticipative whereas farmers who do not are considered as non-anticipative.

2. When disturbance is a reality, individuals implement changes (or don’t) in response to the disturbance according to their perceived sensibility. Farmers who implement these kinds of changes are then considered as responsive whereas farmers who absorb shocks with no or few changes are considered as non-responsive.

In this framework, anticipation and responsiveness translate into the perceived adaptive capacity of producers. This set of categories reflects farmers’ response when facing a possible or proven change. In other words it helps us to analyse the links between LSDUs and PV.

The binary reading of responses as presented above is obviously a considerable simplification of a more nuanced reality. However, this simplification is necessary to enable an analysis of strategic trends expressed by the combination of farmers’ responses in relation to change.

Small-scale farmers deal with uncertainty rather than risk

Now, we must clarify our semantic positioning between the concepts of ‘risk’ and ‘uncertainty’. The distinction between these two concepts was established following the work of Knight (1921). Since then, risk is commonly understood as a measurable probability of a future event and uncertainty as an unmeasurable possibility of such an event.

In this paper, the word uncertainty is used rather than the word risk, because we refer to the small-scale farmers’ perceptions. We consider the ‘numerical objective probabilities’ associated with the concept of risk as largely irrelevant since small-scale farmers do not calculate such probabilities to make decisions. Accordingly, probabilities can be considered as ‘subjective beliefs’, and the distinction between risk and uncertainty is ‘virtually meaningless’ (Moschini and Hennessy 2001).

Long-term strategies for dealing with uncertainty

Previous studies in livestock science about the long-term decisionmaking of farmers defined the logic of action over the long term (or long-term strategies of self-maintenance in an uncertain context) as a group of principles of action or responses in the face of uncertainty (Dedieu and Ingrand 2010). Based on these studies as well as other studies in pragmatic sociology (Hellmann et al. 2009), we refer to these attitudes to facing uncertainty as ‘Rules for Action’ (RAs). We thus define the LSDUs as the set of RAs followed in the long term by farmers in order to deal with uncertainty. As such, LSDUs are not explicitly expressed by the farmer, but instead are a construction by the researcher based on an analysis of a family’s life trajectory.

We identified 11 categories of the farmers’ RAs referring to studies about small-scale farmers’ decisionmaking in situations of uncertainty, and studies regarding ‘adaptive farming systems’ (Milestad 2003; Levrouw et al. 2007; Eakin and Wehbe 2009; Dedieu and Ingrand 2010; Misselhorn et al. 2010). These are (1) diversification of activities, (2) aversion to economic risk, (3) acquiring land area, (4) involvement in collective means of action, (5) modifying management, (6) improving the technical level, (7) taking on debt, (8) saving, (9) prioritising investment, (10) innovating, and (11) maintaining food security.

The RAs of a farmer may be characterised by considering his/her past practices throughout his/her life trajectory and by analysing his/her discourse. We understand ‘discourse analysis’ as ‘the study of language-in-use’ (Gee 1999) and specifically look at the content to catch farmers’ ‘particular way of representing the world’ (Jørgensen and Phillips 2002). In the case of apparent contradictions in the discourse, the RAs must be interpreted in light of the actors’ past practices. In brief, LSDUs of Activity Systems are characterised here through practices and discourse, and through the farmers’ PV.

We can now re-state our framework as follows: (1) the PV is a synthesis of the farmer’s perceptions of his or her exposure, sensitivity, and capacity for adaptation; (2) the tension between the PV and uncertainties leads the farmer to develop LSDUs which (3) are translated into practices that can be characterised (Figure 1).

Study area, sample, data collection and classification methods

The Guatemalan Highlands

A changing vulnerability We worked with small-scale coffee and honey producers in the municipalities of Jacaltenango and San Antonio Huista, in the Guatemalan Highlands. In these neighbouring municipalities the great majority of farmers (more than 90% of them) own and cultivate less than 5 ha (Panjo Reyes 2004; Santay Pop 2007). In the past 50 years, major changes in the coffee economy have introduced them to radically different situations and contexts in terms of vulnerability and uncertainty.

In the early 1960s, most of the land in these municipalities was devoted to subsistence (maize) and marginally to crops for local market (hibiscus,
chipilin, peanuts etc.). In the 1970s, the development of cooperativism in the region caused a progressive expansion of coffee crops at altitudes ranging from 800 to 1500 m. In the 1980s, coffee covered most of the agricultural land. Such coffee expansion corresponds to a reorganisation of Activity Systems and economic life in the villages.

Farmers were then engaged in commercial crop production. As a consequence their food security changed from a subsistence scheme to a cash-dependent one. They were then exposed to international markets, changing the fundamentals of their vulnerability. Furthermore, coffee is a perennial crop that requires some long-term decisionmaking (for example, the selection of the variety). The reorganisation of Activity Systems thus reflected a need to integrate a long-term dimension while adapting to cyclic perturbations in coffee prices, reinforced by a process of market deregulation (Ponte 2002). The first fluctuations in coffee prices coincided with the development of beekeeping for the smallest coffee producers. Bee-keeping then appears as a means to secure an income without having to acquire more land.

Today, the economic landscape of Jacaltenango and San Antonio Huista remains strongly dominated by the coffee sector, and thus by small-scale farmers. However, there now exists a diversity of economic and production activities, revealing both the creativity of farmers facing a changing context and the consequences of repeated crises.

Small-scale coffee producers immersed in uncertainties Historically, commodities markets have experienced the most volatile prices (Jacks et al. 2011). Concerning coffee, a regulation regime appeared during the 1960s through the International Coffee Agreements (ICAs). The collapse of these agreements in 1989 resulted in increased price volatility (Ponte 2002). Small-scale farmers were then exposed to market fluctuations, suffering two major crisis in the early 1990s and the early 2000s (Eakin et al. 2006; Bathfield et al. 2013). As shown by Tucker et al. (2010), low coffee prices are nowadays the major risk concern of small-scale coffee farmers in Guatemala, Honduras and Mexico.

In the long run, uncertainty is multifactorial and cannot simply be limited to the fluctuation in the coffee market. Small-scale producers have to deal with a range of uncertainties such as weather, climate change, pests and diseases, health concerns, development injunctions and so on (Tucker et al. 2010; Ancey et al. 2013). With neither insurance nor social protection, as in the Guatemalan Highlands, each shock may trap small-scale producers’ families into poverty (Courade 2001).

Selection of the sample and data collection To limit the bias of interpretation, we sought to work with a sample as homogeneous as possible, allowing comparison among cases. In 2009, we made an agrarian diagnosis (Audouin and Lorgeron 2009; Cochet 2012) and interviewed 18 leaders and opinion leaders (five technical advisors in coffee and honey production, two coffee cooperative managers, three heads of grassroots organisations, a priest, a political leader, and six elders renowned for their local knowledge). They were selected according to their ability to provide an analysis of the historical context and/or analysis of the coffee sector. These steps helped us improve our knowledge of the local context to refine the selection criteria. As a result, we chose to work with producers who all (1) produce both coffee and honey,
have less than 10 ha of coffee, (3) produce in similar biophysical contexts in Jacaltenango and San Antonio Huista, (4) belong to the same cooperative ‘Guaya’b’ and benefit from the services of this cooperative (technical extension, marketing, loans etc.), and (5) have lived through the 1999–2003 coffee crisis. We then consulted the records and the technicians of the cooperative ‘Guaya’b’ to finalise the sampling and get the names and locations of the producers who fit within these criteria.

In 2010, we carried out two rounds of semi-structured interviews with these producers (Noor 2008). In the first round, we undertook exploratory interviews with the 34 producers and the 18 leaders with two main goals: first, to embed our study within the Guatemalan Highlands’ context; second, to test the validity of the RAs identified in the literature (Table 1). Aside from not being an option for all farmers, the two unselected categories of RAs (‘priorities for investment’ and ‘innovation’) could be subsumed within other categories, such as ‘land purchase’ and ‘creation of reserves’. This round of interviews also defined the historical and current local context.

For the second round, we interviewed the 34 farmers again, focusing on the trajectory of their Activity Systems. Trajectory analysis was based on the evolution of the farmers’ practices and their discourse in order to characterise the RAs and the LSDUs they followed.

### Table 1 Selection and description of the RAs

<table>
<thead>
<tr>
<th>Categories of RAs in the literature</th>
<th>RAs selected for our study</th>
<th>Practices of families in the long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aversion to economic risk</td>
<td>Diversification on international markets</td>
<td>Yes Many household activities are directly connected to fluctuating markets and require extensive use of inputs (example: hydroponic tomatoes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Few household activities are directly connected to fluctuating markets (aside from coffee and honey production)</td>
</tr>
<tr>
<td>Collective means of action</td>
<td>Participation in collective means of action</td>
<td>Yes At least one member of the household has regular responsibilities or is active in collective means of action</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No No member of the household has responsibilities or is active in collective means of action</td>
</tr>
<tr>
<td>Taking on debt</td>
<td>Loans</td>
<td>Yes Frequent use of loans for a variety of purposes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No No or occasional use of loans to respond to exceptional situations (illness for example)</td>
</tr>
<tr>
<td>Food security</td>
<td>Food security</td>
<td>Yes Large or increasing part of the land dedicated to family self-provisioning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Little or no land dedicated to family self-provisioning</td>
</tr>
<tr>
<td>Diversification of activities</td>
<td>Income diversification</td>
<td>Yes High or increasing number of income generating activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Few or decreasing number of income generating activities</td>
</tr>
<tr>
<td>Savings</td>
<td>Reserves</td>
<td>Yes The household tends to create reserves of unexploited land, food, or money</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No No reserves</td>
</tr>
<tr>
<td>Modifying management</td>
<td>Radical changes</td>
<td>Yes Many changes during the trajectory of the Activity System and in technical management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Few changes during the trajectory of the Activity System or in technical management</td>
</tr>
<tr>
<td>Land area</td>
<td>Purchasing additional land</td>
<td>Yes Amount of land owned by the household regularly increases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Amount of land owned by the household remains constant</td>
</tr>
<tr>
<td>Technical level</td>
<td>Technical skills</td>
<td>Yes Proactive attitude toward information; carrying out experiments in technical management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Do not carry out experiments in technical management, do not apply technical skills (pruning for example)</td>
</tr>
</tbody>
</table>

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(2) have less than 10 ha of coffee, (3) produce in similar biophysical contexts in Jacaltenango and San Antonio Huista, (4) belong to the same cooperative ‘Guaya’b’ and benefit from the services of this cooperative (technical extension, marketing, loans etc.), and (5) have lived through the 1999–2003 coffee crisis. We then consulted the records and the technicians of the cooperative ‘Guaya’b’ to finalise the sampling and get the names and locations of the producers who fit within these criteria.

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### Statistical methods for classifying farmers

To make the RAs emerge from the producers’ practices, we referred to other studies that proceeded...
in a similar manner (Lemery et al. 2005; Levroux et al. 2007; Dedieu and Ingrand 2010). Nevertheless these studies were livestock studies carried out in different contexts from ours (France and South America). We thus had to adapt some of the practices considered in these works to coffee production in the Guatemalan Highlands. As an example, when characterising the expansion dynamics of farming systems, these works refer to the acquisition of land but also to the increase in herd size. We only considered the acquisition of land insofar as animal breeding is not characteristic of farming systems in our context. For some other RAs, we just transposed the practices since they were not specific to the context or to the production (for example, to characterise the diversification of activities).

Consequently our interview guidelines systematically focused on the practices related to each identified RA. For example, with respect to the RAs about technical change, we interviewed producers on their technical management changes to coffee plantations and apiaries since their inception. We adopted the same scheme for all the RAs. The practices considered to define producers’ RAs will appear below, along with the presentation of results.

To identify trends in the coffee and honey producers’ long-term strategies, we used statistical methods to generate typologies with a high number of variables and a restricted number of cases (Nakache and Confaïs 2004). As in other studies, we combined a factorial analysis and a method of classification (see as example, Milan et al. 2003).

Our method consists of combining an multiple correspondences analysis (MAC) and a hierarchical classification method based on Ward’s method (Escofier and Pagès 2008; Bathfield et al. 2013). MAC transforms nominal raw data into quantitative vectors within a multidimensional space. This step is necessary to use Ward’s method, which is used to classify cases based only on quantitative data. Ward’s method constructs a dendrogram which classifies cases according to their statistical proximity. These analyses were carried out with the SPSS 15.0 program. It is worth noting that the methods used do not always lead to exclusive classifications: increasing the variables results in a less exclusive classification. The resulting groups should only be interpreted as qualitative trends.

Results

RA of coffee and honey producers

Through the analysis of farmers’ practices and discourse, we now characterise the nine categories of RAs according to their proportions among the sample, and what they reveal in terms of levels of anticipation and of responsiveness. Each of these categories is divided into two possible RAs (present or absent).

1. Diversification on international markets. Fifty percent of coffee and honey producers diversify their activities and bet on international markets. This often highlights an opportunistic attitude towards the possibility of a disturbance (without necessarily any practice of anticipation) and a bet on the responsiveness of their Activity System to go through disturbances (for example, while talking about the reasons for having developed a production of tomatoes for mass distribution, a producer said ‘In order to move forward, one has to take risks with what will bring money’). On the other hand, the 50% of coffee and honey producers who did not develop activities connected to international markets demonstrate some fear of uncontrolled economical disturbances, leading to an attitude towards the possibility of disturbance that is rather anticipative.

2. Participation in collective means of action. Sixty-eight percent of coffee and honey producers participate in collective means of action distinct from the cooperative Guaya'b. They have several objectives: from cost reduction, through collective purchase, to access to markets and technical information (for example, talking about his feeling about collaborating with other producers or neighbours, a producer answered ‘I always participated in organisations. Since we are many, it helps us to sell and gives us credit’). This way, coffee and honey producers anticipate the possibility of a disturbance. During disturbance periods, the participation in collective means of action increases coffee and honey producers’ possibilities of responding to disturbances. For example, during the 1999–2003 coffee crisis, some coffee and honey producers created new associations to diversify their agricultural activities. Concerning the 32% of coffee and honey producers who do not participate in collective means of action, this RA reveals a search for autonomy in decisionmaking (talking about a group of producers, created to manage irrigated land, another producer, who did not belong to this group, said ‘I don’t trust organisations. There is always someone who wants to use it for their own benefit’).

3. Loans. Seventy-six percent of coffee and honey producers have developed Activity Systems which are dependent on loans, while the rest have never contracted debts (not even with the cooperative, which offers preferential rates to purchase the sugar used to feed bees). Loans can be mobilised in various ways: some use them as a way to ensure their living during lean times; others use loans to improve their means of production (for example, we heard ‘I need to take out loans if I want to improve [my coffee plantation]’). In the case of never (or exceptionally) using loans (24%), this practice reflects a search for economic autonomy.
As an example, a producer expressed his aversion towards loans as a risk to lose money and resources: ‘I never subscribe loans because then you have to pay interest and they take everything away from you’. These coffee and honey producers clearly anticipate the possibility of a disturbance even if this attitude deprives them of a mean for action in case of disturbance.

4. **Food security.** Fifty-nine percent of coffee and honey producers have grown food for self-sufficiency (or food security) as a way to lower costs and absorb shocks. This trend also reflects some identity claiming. Talking about self-supply productions, a farmer said: ‘One can’t be a peasant and have to buy food’. This practice thus reveals a longing for autonomy and anticipating possible disturbances. It also permits coffee and honey producers to absorb shocks with few changes. On the contrary, the 41% of coffee and honey producers who did not grow food for self-sufficiency do not anticipate a possible lack of food security and need to increase their responsiveness to disturbance.

5. **Income diversification.** Seventy-four percent of households have diversified their income sources. Coffee and honey producers justify this decision as a way of risk dispersion. A significant comment was: ‘One is like a tree. You need several roots because if one dies, the others can take over’. Nevertheless this RA can be interpreted in two ways according to coffee and honey producers’ attitudes towards selling in risky markets. Whenever the income diversification is combined with selling in new risky markets (50% of coffee and honey producers), the objective is to maximise income with risky activities (such as production of avocados, pears or hydroponic tomatoes). Whenever income diversification is combined with an aversion to selling in risky markets (50% of coffee and honey producers), farmers develop low-risk activities to reduce costs. For example, a farmer may open a store to purchase wholesale products which are useful to his family (oil, soap) or as an input for economic activities (sugar to feed the bees) and to sell some of the excess for a little additional income. Concerning the 26% of coffee and honey producers who do not diversify their incomes, they are clearly in search of control. A common way to express it, when we were talking about the possibility of developing new activities, was: ‘He who takes on a lot achieves little’.

6. **Reserves.** Seventy-four percent of households have reserves (land, savings or grain), anticipating cases of disturbance (for example, when we were talking about making reserves, some said ‘One always needs some reserves because unexpected things always happen’). These coffee and honey producers are in a dynamic of absorbing shocks with few changes. In the case of not having reserves (26%), coffee and honey producers are rather willing to optimise their resources in spite of the risks. Consequently these coffee and honey producers do not anticipate disturbances by changing their practices. The choice of some coffee and honey producers to function without reserves requires taking a chance on their responsiveness in the case of a disturbance.

7. **Radical changes.** Fifty percent of coffee and honey producers are on the lookout for opportunities, constantly adapting the form of management of their Activity System. For example, some coffee and honey producers change their management according to the possibilities of international migration: ‘If the border opens again, I’ll go back to the US’. This opportunistic attitude does not reflect any anticipation but a high responsiveness to disturbances. On the contrary, 50% of coffee and honey producers barely changed the management of their Activity System (‘I’ve always worked that way, and my father also worked that way’), revealing some willingness to absorb shocks with as few changes as possible.

8. **Purchasing additional land.** Seventy-nine percent of coffee and honey producers have regularly purchased additional land (at different rates, according to what they can afford). Beyond the tendency to concentrate land holdings among coffee and honey producers in this sample, this RA reveals a search for security. Indeed, farmers justify this attitude with the principle ‘Bigger is safer’. It thus reveals an anticipative attitude towards the possibility of a disturbance in order to absorb shock with no or few changes in the case of such an event. On the contrary, 21% of coffee and honey producers did not regularly purchase additional land. They rather look for some control, in terms of work organisation particularly. ‘I can’t grow more because then one has to pay more workers’ was a common justification. This attitude is also anticipative of the possibility of a disturbance. Nevertheless these coffee and honey producers bet on their ability to implement changes in the face of disturbance thanks to the flexibility provided by the family workforce (Bathfield et al. 2013).

9. **Technical skills.** Seventy-six percent of coffee and honey producers made efforts to improve technical skills to withstand shocks and optimise the use of their resources (a producer developed this idea: ‘If one doesn’t improve his way of producing, he doesn’t get the most of what he owns, and then he goes broke’). This lookout for optimisation reveals a certain fear of going bankrupt, so it can be interpreted as an anticipative attitude. In terms of attitude towards a disturbance, this RA permits coffee and honey producers to implement technical changes in case of disturbance and, as such, to be more responsive. On the other hand,
24% of coffee and honey producers did not look for an improvement of technical skills. This RA clearly signifies a reliance on durable technical management, with these coffee and honey producers adopting few technical changes when faced with disturbance (and showing little evidence of responsiveness).

Table 2 summarises these results and allows an analysis of the trends within the selected RAs in this study. We notice that RAs mainly reflect anticipative attitudes towards the possibility of disturbance. Eight RAs of 18 reflect this attitude and are associated with high proportions among the sample, while the ‘not anticipative’ attitude is represented by only four RAs with low proportions. Concerning what the RAs reflect in terms of responsive attitude to disturbance, we observe a more balanced situation. Seven RAs reveal responsive attitudes and six a ‘non-responsive’ attitude and proportions are quite equally distributed among RAs.

Nevertheless, this analysis does not provide sufficient detail to provide an overall assessment of farmers’ attitudes towards the possibility of a disturbance and in response to a given disturbance. We observe that a third of RAs are not representative of any attitude towards the possibility of a disturbance (six RAs) and that five RAs of 18 are not representative in terms of responsiveness to a disturbance. In other words, only a general view of the relationships among the RAs used by farmers can characterise farmers’ LSDUs in terms of anticipation (or not) and responsiveness (or not).

**Characterisation of long-term strategies for dealing with uncertainty**

Figure 2 shows a dendrogram grouping the coffee and honey producers according to the similarity of their combinations of RAs. Five groups were identified, with four nodes of differentiation. Figure 3 describes the resulting clusters (corresponding to LSDUs). Based on these figures we now characterise and interpret the combinations of RAs – LSDUs – and interpret LSDUs through the three dimensions of perceived vulnerability (exposure, sensitivity, and adaptability).

LSDU A ‘Exposed and sensitive but highly reactive’ Despite active participation in collective means of action to secure and optimise marketing channels, the exposure of this group of coffee and honey producers to market shocks remains high since they constantly seek to maximise their incomes by selling in risky markets. Thus, they tend to diversify their income-generating activities by taking economic risks and taking out loans. Their dependence on income-generating activities also increases their sensitivity to market shocks. This risky strategy of maximising incomes is balanced by owning more land and/or savings. However, their strategy to

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Table 2 Characterization of RAs of small-scale coffee producers

<table>
<thead>
<tr>
<th>RAs</th>
<th>%</th>
<th>Attitude towards the possibility of disturbance</th>
<th>Attitude towards disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Anticipate</td>
<td>Do not anticipate</td>
</tr>
<tr>
<td>Diversification on international markets</td>
<td>Yes</td>
<td>50%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>50%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Participation in collective means of action</td>
<td>Yes</td>
<td>68%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>32%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Loans</td>
<td>Yes</td>
<td>76%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>24%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Food security</td>
<td>Yes</td>
<td>59%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>41%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Income diversification</td>
<td>Yes</td>
<td>74%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>26%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reserves</td>
<td>Yes</td>
<td>74%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>26%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Radical changes</td>
<td>Yes</td>
<td>50%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>50%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Purchasing additional land</td>
<td>Yes</td>
<td>79%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>21%</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Technical skills</td>
<td>Yes</td>
<td>76%</td>
<td>X</td>
</tr>
<tr>
<td>No</td>
<td>24%</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
prevent disturbances focuses primarily on their responsiveness. Therefore, all coffee and honey producers in this group are constantly looking for technical information to help them adapt their decisionmaking.

**LSDU B ‘Exposed but not very sensitive, with a tendency towards little responsiveness’** These coffee and honey producers take economic risks, even as they tend to diversify their incomes. They also depend on loans. As a consequence, despite their involvement in collective means of action, they remain exposed to market shocks. These coffee and honey producers balance this exposure by producing for self-provisioning, and continually seeking to improve their technical skills to optimise production. This way they reduce their sensitivity to shocks. This balance is strengthened by their seeking to own more land and establishing reserves of food, land and/or cash, as ways of achieving some permanency.

**LSDU C ‘As little exposed as possible, little sensitivity and endurance’** This group of coffee and honey producers seek to reduce their exposure to international markets by combining reduced risk-taking in terms of marketing with an involvement in collective means of action. As they diversify their activities, they seek to reduce family expenses with activities that allow for purchasing in bulk, and selling surpluses. These activities require minimal investment, and thereby they avoid taking on much debt. Nevertheless, those who do take on debt continue to follow the logic of cost reduction by taking advantage of the cooperative’s preferential rates to support coffee and honey production. These coffee and honey producers seek to absorb disturbances with few changes by increasing their land possessions and reserves, and by optimising productivity with technical knowledge. Despite this search for endurance, few coffee and honey producers build up reserves.

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Figure 2 Dendrogram using Ward’s method. (1) Diversifying on international markets. (2) Participation in collective means of action. (3) Food security. (4) Loans. ‘Rescaled distance’ = distance between cases and emergent clusters.
LSDU D ‘Decreased exposure, as little sensitivity as possible, and little responsiveness’ These coffee and honey producers reduce their exposure by avoiding selling in risky markets. Their Activity Systems are diversified with multi-purpose crops which cover self-provisioning and are also sold in the local market. This LSDU does not involve collective means of action or debt contracting; rather, these coffee and honey producers look for autonomy in securing their food and grain stocks. This strategy is characterised by a high level of permanency of the management of their Activity Systems: none of these coffee and honey producers have changed their management or the structure of their Activity System towards the possibility of a disturbance or when they face a given disturbance. Few of this group of coffee and honey producers express interest in technical improvement. Despite their willingness to increase the amount of available land, possibilities are limited by lack of financial resources so they often do not even look for it.

LSDU E ‘Exposure transferred little sensitivity and widely varying adaptive capacities’ This group of coffee and honey producers avoid exposure to market shocks. However, they all rely on loans to maintain their Activity Systems and none engage in collective means of action. This results in a shift in exposure as their links with international markets are relatively low but their protection against possible markets shocks is low too. This position is partially offset by a decreased sensitivity. These coffee and honey producers take out loans to acquire more land or to create reserves. All other RAs are followed by 50% of these coffee and honey producers and do not contribute to the characterisation of their LSDU.

**Discussion**

We now propose to discuss our results by focusing on the relative importance of context in affecting farmers’ LSDUs, and what the results suggest at an institutional scale.

*The importance of context in implementing LSDUs*

We designed our work to limit the possible effects of context on the differentiation of small-scale farmers’ strategies. This can be analysed in two ways: first, by considering how strategies vary even within a homogeneous context; and second, by comparing the
influence of the Guatemalan Highlands to the context in France where similar studies were conducted.

On the one hand, we notice that, even within a homogeneous socio-economic and political environment, small-scale farmers still develop several different strategies depending on their degree of anticipation or responsiveness to the possibility and/or reality of a disturbance. Thus, the context is not the sole determinant of long-term strategies for dealing with uncertainty: different strategies coexist, even in a very homogeneous sample, and depend on adaptive attitudes towards uncertainty. Thus, we can question the notion that ‘adaptation is more a function of exogenous constraints on decision-making than [risk] perception’ (Tucker et al. 2010). In our case study, the farmers’ room for manoeuvre to establish long-term decisionmaking is conditioned by both exogenous constraints, and a combination of the perceptions of uncertainties.

On the other hand, unlike previous studies carried out in France about long-term strategies of livestock breeders (Lemery et al. 2005), we have not observed strategies essentially based on increased means of production (land acquisition, for example) nor on the ability to activate social networks and to draw on public support (such as insurance in the case of the 2003 drought in France). Even if this finding is not new nor surprising, it highlights the strength of the socio-economic and political environment in the implementation of farmers’ LSDUs. Indeed, the huge difference between the context of the Guatemalan Highlands and France lies in the lack of social protection (retirement insurance, medical care insurance, social assistance and loss-of-income insurance) in Guatemala. Today, such social protection in Guatemala remains wishful thinking; nevertheless it might be necessary to lower the small-scale farmers’ vulnerability (objective and perceived) and might induce more stable long-run dynamics (HLPE 2013). As such, the reflection is worth pursuing. Our work therefore offers some basis for developing a discussion of the roles of institutions.

The role of institutions

The previous paragraphs highlight the dichotomy between structural determinism and the farmer as a fully and freely rational individual. This observation makes the interface between farmers and society central, when societal goals (such as the so-called sustainable development) coincide with those of farmers. Then, the role of the cooperative is crucial and deserves some attention, as these are the institutions with which farmers (at least in our work) are most associated.

Concerning the articulation between the cooperative and farmers’ decisionmaking, this study suggests differentiating two main periods in the reading of farmers’ trajectories. On the one hand, periods of relative calm, when disturbance is a possibility; and on the other hand, periods of ‘disruption’ (Moulin et al. 2008), when the disturbance is a reality. From the cooperative standpoint, this approach suggests providing the means of action (1) to allow some anticipation of possible disturbances during periods of relative calm (for example by facilitating the establishment of reserves by collective infrastructures, encouraging training for the diversification of activities, securing new markets and so on), and (2) to facilitate the strength or endurance of coffee and honey producers in times of disturbance (e.g. through a policy of emergency loans). It is thus important for cooperatives to be able to recognise that both kinds of periods will arise; in order to adapt their collective means of action to different conditions at appropriate times, for the benefit of the majority of their members. In general terms, this is a call for deepening the growing field of farming studies which link different conceptual frameworks (such as resilience, flexibility or vulnerability) to reveal adaptive processes and decisionmaking in their distinct temporal dimensions (see as examples, Milestad and Darnhofer 2003; David et al. 2010; Dedieu and Ingrand 2010; Astigarraga and Ingrand 2011). Concerning the articulation between the cooperative and societal goals, this logic also requires us to understand ‘the standpoint of the institutions, policy processes, cultures and economies’ (Eakin and Lemos 2010) in order to articulate harmoniously individuals’ motivations and societal goals.

Conclusion

According to our results, during their life trajectories, small-scale coffee and honey producers make decisions in order to deal with uncertainties, whether in bypassing or facing them to maintain themselves in the long run. These decisions refer to many registers of uncertainty (international markets, loans etc.), and/or rely on many means of action (collective action, productions for self-sufficiency etc.). As a consequence, small-scale producers must balance their decisionmaking according to their perceived vulnerability. Thus we could identify some trends in their decisionmaking, called the LSDUs, and analyse them through the three dimensions of PV. To deal with uncertainties the producers develop personalised long-term strategies by adopting and combining four major attitudes according to their PV. These attitudes are (1) increasing responsiveness, (2) a search for autonomy, (3) a shift in vulnerability, and (4) relying on collective means of action.

Increasing responsiveness reflects both risk-taking attitude and opportunistic attitudes. In other words the Activity System is perceived as highly exposed and sensitive which implies greater risks. The future of such systems depends on the availability of alternative options whenever a shock occurs. On the contrary, a search for
autonomy refers to a risk-avoidance attitude and aims to maintain the Activity System’s stability. The future of these Activity Systems then depends on other types of uncertainty, rather than solely on price volatility.

Vulnerability shifts refer to loan-based Activity Systems. The global vulnerability of the Activity Systems then mostly depends on the accessibility of loans rather than directly on market fluctuations. Nevertheless, this shift is also accompanied by a major risk of bankruptcy. It is then necessary to differentiate chronic indebtedness for productive investments from permanent debts for consumption purposes (Viciano 2013; Kennedy and King 2014).

Finally, collective means of action, as described in this work, is a way to lower the exposure of the Activity System. Furthermore, collective action also offers various opportunities to producers such as operating vulnerability shifts through loans while lowering the associated risks (microcredit) thanks to a better accessibility (Anthony 2005), or aiming at increasing autonomy on a local scale, promoting circular economy (Jing 2012).

From this perspective, collective means of action appear to be the most efficient way to decrease the producers’ vulnerability. Yet, our results show that producers tend to distrust collective action. This stresses the need to create adequate conditions for collective action to emerge in contexts such as the Guatemalan Highlands, where social protection is almost inexistent. This requires actions that increase farmers’ options so they can mobilise external resources and develop their own sustainability (Darnhofer et al. 2010). In particular, this implies the development and stabilisation of social resources, either on an institutional level (standards and interconnections) or in the management of commons (Ostrom 1994; Pretty and Ward 2001).

Our work also questions producers’ adaptive strategies and the way they interact at different temporal scales. We observed that producers’ LSDUs remained the same during their whole trajectory or changed because of the 1999–2003 coffee price crisis (Bathfield 2013). Indeed, some producers changed some of their RAs due to the crisis. In fact, the main observed change is a greater implication within collective action. This way, we show that there can be some feedback between long-term adaptive strategies and short-term ones, which were described and analysed in a previous study (Bathfield et al. 2013). Such feedback proves that LSDUs are not carved in stone and can sometimes change according to experience.

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