



## **ADAPTING TO DROUGHT IN THE HORN OF AFRICA BY MARKETING: HOW MARKET ORIENTATION CAN HELP PASTORALISTS TO ADAPT TO CHANGING CLIMATIC CONDITIONS**

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### **Abstract**

Severe drought is becoming more frequent due to the changes in climatic conditions particularly in parts of Africa. For example, in 2011 the Horn of Africa was hit by a massive drought that affected more than 12 million people across the region. Such droughts severely affect the livelihoods and sustainable development of agricultural producers, in particular, pastoralists. For example, studies report that pastoralists in northern Kenya lost up to 70% of their herd during the 1984 drought. In order to sustain their livelihood and economic contribution (e.g., protein supply), pastoralists are required to enhance their adaptation to the changes in climatic conditions. One way of adaptation by pastoralists is to sell a part of their herd in advance of the droughts, and buy or reproduce after the droughts when pasture and water are more available. Marketing can facilitate such a process of destocking and restocking. A study by FAO indicated, for example, that given advance forecast for the drought, marketing can increase the ability of pastoralists to transfer their livestock into other

assets such as cash. A cash income that is generated from advance livestock selling in turn can be reinvested to livestock after the drought.

This study uses a semi-experiment to understand how market orientation influences the impact of climatic conditions on pastoralists' intended herd size change. The results show that the three components of market orientation: customer orientation, competitor orientation, and interfunctional coordination play specific roles in this relation. Customer orientation and interfunctional coordination enhance the adaptability of pastoralists to the changes to climatic conditions, while competitor orientation weakens their adaptability. Drawing on resource dilemma theory, the study further shows that confirmation of the formal forecast by pastoralists' informal (traditional) methods of forecasting influence pastoralists' intended herd size change. Further the study shows that the effect of market orientation on the relationship between formal forecast and the intended herd size change is stronger when the formal forecast is disconfirmed by the informal forecast. Overall, a higher market orientation has a significant role for pastoralists in changing their herd size to adapt to the changes in climatic conditions. The results imply that policy measures that focus on enhancing the motivation of pastoralists for enhanced market orientation can contribute to their adaptation to the change in climatic conditions.

**Key words:** Pastoralists, climatic conditions, adaptation, marketing, forecasting

## **1. Introduction**

Severe drought is becoming more frequent due to the changes in climatic conditions particularly in parts of Africa (e.g., Mwebaza, 2009). For example, in 2011 the Horn of Africa was hit by a massive drought that affected more than 12 million people across the region (Cambridge University Press, 2011; FAO, 2011). Such droughts severely affect the livelihoods of agricultural producers, in particular, pastoralists. Recurrent droughts can affect the livelihood and sustainable development of pastoralists (e.g., De Haan, 2000).

Pastoralists live with herds of domesticated animals, which they move to take advantage of natural pasture for grazing (e.g., Koocheki & Gliessman, 2005). In dry environments where rainfall cannot sustain crop-based livelihoods, pastoralism is the dominant way of life for an estimated 200 million people (WISP, 2007). Practiced on 25% of the world's land area, pastoralism provides about 10% of the global meat production (FAO, 2001).

Pastoralists tend to build herds during wet years while these herds may be significantly reduced during dry years (Davies & Bennett, 2007). For example, Little (1992) reports that pastoralists in northern Kenya lost up to 70% of their herd during the 1984 drought. In order to sustain their livelihood and economic contribution (e.g., protein supply), pastoralists are required to enhance their adaptation to the changes in climatic conditions. One way of adaptation by pastoralists is to sell a part of their herd in advance of the droughts, and buy or reproduce after the droughts when pasture and water are more available. Marketing can facilitate such a process of destocking and restocking. A study by FAO indicated, for example, that given advance forecast for the drought, marketing can increase the ability of pastoralists to transfer their livestock into other assets such as cash (Rass, 2006). A cash income that is generated from advance livestock selling in turn can be reinvested to livestock after the drought (Rass, 2006).

To date, however, policy makers in pastoralism apply marketing predominantly as a short term, ad-hoc solution by strengthening the sale of livestock during the occurrence of droughts (e.g., Morton & Barton, 2002; Watson & Binsbergen, 2006). They therefore overlooked that marketing is also a competence with a strategic focus on customer value creation (e.g., Hunt & Morgan, 1995). The marketing literature has addressed this competence in the market orientation concept (Kohli & Jaworski, 1990; Narver & Slater, 1990). Market orientation includes the generation and dissemination of information on customers and competitors as well as the factors affecting them (Kohli & Jaworski, 1990). These factors also include climatic conditions. Market-oriented pastoralists are therefore more likely to know

what the market wants, and when responsiveness is required. They will thus be able to sell when the climatic conditions necessitate or demand them to do so.

In this study we examine the role of market orientation in the adaptation of pastoralists to droughts. In order to understand the role of market orientation, we build on resource dilemma theory, which was previously introduced to the marketing and public policy literature (e.g., Shultz & Holbrook, 1999) but has not yet been related to market orientation. Empirically we conduct a semi-experiment on 232 pastoralists from Ethiopia.

In the following sections, we first provide the conceptual framework and hypotheses to our study. Next we offer a description of the method of our study. Finally, we present the empirical results, discussion, and implications.

## 2. Conceptual framework and hypotheses

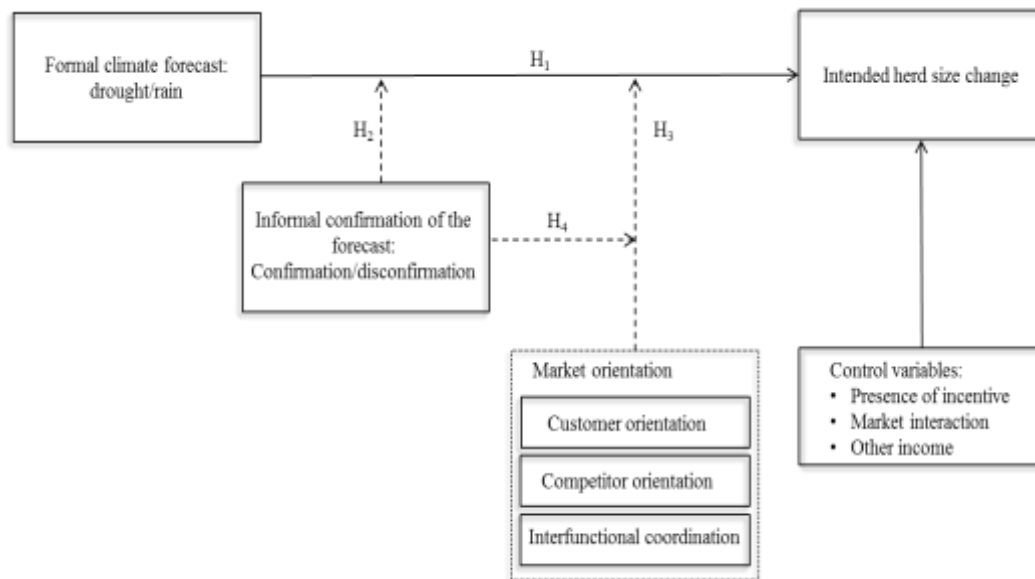
The conceptual framework of the study is shown in Figure 5.1 It is important that pastoralists adapt to the changes in climatic conditions by changing their herd size because it sustains their livelihood and the supply of animal based proteins for the growing urban populations in the developing world (e.g., Ash & Smith, 2003; Delgado et al., 1999). Herd size change refers to the decrease or increase of livestock. Because different types of livestock have different impacts on the natural environment, ecologists recommend taking those impacts into account in range management (e.g., Wilson & MacLeod, 1991; Bagchi & Ritchie, 2010).

Research has shown that if pastoralists know in advance that droughts will occur, they are more likely to decrease their herd by selling to minimize losses (e.g., Khan, 1994; Turner & Williams, 2002; Holtzman & Kulibaba, 1994). At the same time if pastoralists know in advance the occurrence of rain, they are more likely to increase their herd by breeding or by buying from the market. Ecologists have therefore emphasized the importance of formal forecast information on climatic condition (hereafter, formal forecast) to enhance pastoralists' adaptation to the changes in climatic condition through herd size change (e.g., Ziervogel & Zermoglio, 2009; Galvin et al., 2004). With formal forecast we refer to the meteorological information that is provided to pastoralists (at least three months in advance) by formal institutions like weather forecast stations. In line with the above argumentation, we hypothesize:

*Hypothesis 1:* Formal forecasts that predict drought (rain) will lead pastoralists intend to decrease (increase) their herd size.

However, pastoralists may not always sell a part of their herd in times of drought because they may be driven by short-term self-interests (e.g., Hardin, 1968). They may, for example, think that keeping a larger herd during drought gives them more security so that a part of their herd still survives after the drought as a basis to rebuild their herd. Meanwhile they may hope that others will decrease their herd and that the natural environment thus remains relatively unchanged. But if all pastoralists are not responding to the drought by selling a part of their herd, natural resources can be overused. Hardin (1968), in his famous Tragedy of Commons thesis, stated that when pastoralists pursue short-term benefits from increasing their herd size at the expense of the long-term preservation of communal resources, sustainability is in jeopardy. The choice whether or not to change the herd size can therefore be approached as a resource dilemma to pastoralists.

Resource dilemma refers to a situation in which a group shares a scarce natural resource from which the individual members can harvest, and the group runs the risk that excessive harvest leads to the depletion of the resource (Van Dijk et al., 1999). Van Vugt (2009) distinguished four different directions to avert resource-dilemmas towards greater cooperation, of which two seem particularly relevant in the context of pastoralists. First, by providing information policy makers can reduce the uncertainty of people on their environment. In the context of pastoralists, this uncertainty essentially comes down to whether the climate forecast provided to them by formal institutions is perceived as credible or not. Second, by providing incentives for responsible use, policy makers can make use of people's self-enhancement motivations: the need to improve oneself and increase one's resources. The other two directions (strengthening belonging by improving one's sense of community and increasing the acceptance of common's rules and institutions), are less relevant in the context of pastoralists because East African pastoralists rely on strong traditions that advocate sense of community and respect for clan elders that may set rules for responsible use of common resources (e.g.; Swift, 1991; Little & David, 1987). Given the recent problems with the potential overuse of natural resources by pastoralists during unexpected heavy droughts (e.g., Speranza, 2010; Blench & Marriage, 1999), providing information and incentives may however increase the responsible use of natural resources. Our framework therefore includes an informational factor (informal confirmation of the forecast) and a variable of self-enhancement (market orientation), as well as the interaction between them.



**Figure 1.** Conceptual framework of the study

### 2.1 Informal confirmation of the forecasts

Through information, resource users can better understand the physical, social, and economic consequences of their behaviour. If such information is perceived as more reliable the behavioural change towards cooperation is stronger (Van Vugt, 2009). Consistent with the context of pastoralists we propose that the effect of formal forecast on pastoralists' intended decision to change their herd size, is moderated by the *informal confirmation of the forecast*.

Informal forecast refers to the traditional climate forecast made by pastoralists using their traditional knowledge systems. Traditional knowledge systems are developed over centuries, and include traditional techniques like astronomy, studying the belly of a goat, bird singing, seasons, growth patterns of flowers, and animal behaviors (Aklilu & Wekesa, 2002). For example, wise-men so-called *Hayyuu* of Borana pastoralists in Ethiopia correctly forecasted the worst drought that devastated the Horn of Africa in 2011 (IRIN, 2011). Those pastoralists who followed the advices of *Hayyuu* sold a part of their herd before the drought and were able to minimize their herd loss and damage to the ecology (IRIN, 2011). Both systems can therefore play a role in providing information to pastoralists (Luseno et al., 2003; Esipisu, 2012).

If the formal forecast is not confirmed by the informal forecast of traditional knowledge system, pastoralists may consider the forecast as uncertain; limiting their cooperation for herd size change (e.g., van Dijk, et al., 1999). Hence, scientists argued that formal forecast should

be integrated with informal (traditional) forecast to be effective in the context of pastoralists (e.g., Borad & Agrawala, 2000). Based on this we hypothesize as follows:

*Hypothesis 2:* The effect of formal forecast on intended herd size change is stronger if the informal forecast confirms, and weaker if it disconfirms, the prediction of the formal forecast.

## *2.2 The role of market orientation*

Market sensing, like the search for market information, sharing market information within an organization, and responding to the market in, for examples, the design and supply of products to customers, are core processes that are exercised by market-oriented firms (e.g., Kohli & Jaworski, 1990). Market-oriented firms therefore respond better to the requirements of buyers than firms that are less market-oriented (e.g., Ruekert, 1992). Market orientation is conceptualized by Narver and Slater (1990) as three behavioral components: customer orientation, competitor orientation, and interfunctional coordination.

Customer orientation refers to ‘the sufficient understanding of one’s target buyers to be able to create superior value for them continuously’ (Narver & Slater, 1990, p. 21-22). In the context of pastoralists, customer orientation means doing business through practices such as raising improved breeds or fattening which are valued by buyers. Competitor orientation is an understanding of ‘the short-term strengths and weaknesses and long-term capabilities and strategies of both the current and the key potential competitors’ (Narver & Slater, 1990, p. 21-22). Being competitor oriented can help pastoralists to know what other pastoralists are doing in the market because they observe, and discuss actions of other pastoralists in the market.

Interfunctional coordination involves ‘the coordinated utilization of company resources in creating superior value for target customers’ (Narver & Slater 1990, p. 22). This concept is less straight forward to apply in the pastoralists’ context because formal organizations with departmental units are absent. Communication processes, and coordination between specialized functions in the creation of customer value must therefore involve two or more network actors. Pastoralists make use of (clan) brokers, who can be relatives (such as clan brokers) living in or around market places, to facilitate market information to pastoralists who are largely in the field to feed livestock. For example, brokers advise pastoralists which breed type is in demand by buyers, and which livestock type is more profitable. Similarly, pastoralists can build on other pastoralists’ knowledge about breeding and fattening.

We expect that pastoralists that are more market-oriented create more customer value than their non-customer-oriented counterparts, just like other market actors would (e.g., Slater, 1997). Market-oriented pastoralists are more likely to produce what buyers value. As a consequence, in times of dry periods, market oriented pastoralists offer the value that the market demands and they can sell more easily as compared to their non-market-oriented counterparts. In times of rain, they subsequently are better able to benefit from the market and thus increase their production. This means that a higher degree of market orientation represents also a higher degree of self-enhancement when natural resources are used responsibly.

Because a market orientation is inherently focused on long-term advantage by creating customer value rather than short-term gains, it is also an intrinsic motivation to conserve. Literature on resource-dilemma has questioned the effectiveness of economic incentives as a solution to resource-dilemma because they may in fact undermine this intrinsic motivation to conserve (Van Vugt, 2009; Deci et al., 1999). For example, a meta-analysis study conducted by Deci et al. (1999) showed the existence of the detrimental effects of extrinsic rewards on intrinsic motivation. Importantly, market orientation in theory would not be prone to this undermining effect of economic incentives. When a forecast predicts that the climatic situation demands herd size change, pastoralists with a higher market orientation are therefore more willing and able to change their herd through markets than those who are less market-oriented. Because all three components of market orientation contribute to value creation (e.g., Narver & Slater, 1990), we hypothesize as follows:

*Hypothesis 3:* The higher: (a) customer orientation, (b) competitor orientation, and (c) inter-functional coordination, the stronger the relationship between formal forecast and intended herd size change.

The combination of self-enhancements and long-term focus that is embedded in a market orientation becomes particularly important in situations when the climate forecast is uncertain (in our case when the formal climate forecast is not confirmed by the informal forecast). Social psychologists have found that uncertainty tends to promote overuse of natural resources because most users are optimistic about the future and underestimate the damage that they are doing to the environment (Opatow & Weiss, 2000; Biel & Garlinc, 1995). Whereas in situations of certainty the informational intervention may therefore be strong enough by itself to generate responsible behaviors, under conditions of uncertainty that is very unlikely. In these uncertain conditions, the role of market orientation therefore

becomes more important to ensure responsible use of natural resources. Thus, we hypothesize:

*Hypothesis 4:* If informal forecasts disconfirm the formal forecasts, the stronger the moderating effects of (a) customer orientation, (b) competitor orientation, and (c) interfunctional coordination, on the relationship between formal forecast and intended herd size change.

In order to assess whether market orientation indeed plays a different role in the resource dilemma than an economic incentive, this study will systematically assess the presence of an economic incentive for selling livestock of good quality (i.e., the establishment of a quality assessment center at the market that can remove the information asymmetry between buyers and sellers on the quality class of the livestock). We therefore include the presence of incentive as a control variable in our framework. In addition, the framework includes market interaction and other income as control variables. *Market interaction* refers to the extent to which pastoralists are involved in selling and buying of livestock. By including this variable, we recognize that the integration of pastoralists with the market (e.g., Davies, 2008; Fratkin & Mearns, 2003; Williams & Turner, 2002), rather than market orientation components, might drive intended herd size change. *Other income* refers to the extent to which pastoralists are involved in other activities such as crop farming and livestock trading besides the pastoral domain of livestock raising. Other sources of income may make pastoralists less dependent on the livestock market, and hence they may feel less pressure to sell (Bayer & Waters-Bayer, 1989).

### 3. Method

#### 3.1 Overview of the study

We conducted a semi-experiment among pastoralists in Ethiopia to test our hypotheses. The semi-experiment manipulates the formal forecast, informal confirmation of the forecast, and presence of incentive variables. The market orientation components are measured directly as characteristics pertaining to pastoralists themselves.

Following advises of marketing researchers focusing on emerging markets (Arnould, 2001; Burgess & Steenkamp, 2006), we conducted a prestudy that featured desk and qualitative research in preparation of the main study. Our desk review involved a survey of related literature on pastoralism and marketing practices. The qualitative prestudy included

125 individual interviews, 14 focus group discussions, and 28 field observations across different regions, including pastoralists, brokers, traders, slaughterhouses, and exporters. We also interviewed 13 experts, like policy makers and development experts. The desk search and qualitative analysis helped us to create a deeper understanding of the research context, design the stimuli for the semi-experiment, determine our unit of analysis, select the areas for stratified sampling, and generate specific market orientation scales to fit the context of pastoralists.

### *3.2 Participants and design*

Participants in the semi-experiment are 232 male pastoralists (with age  $M= 39.14$ ,  $SD= 12.54$ ) in two areas of Ethiopia. Our qualitative prestudy revealed that the male head of the household is primarily involved in the actual livestock selling and buying. Therefore, we use the household level as our unit of analysis and the household head as the key respondent. Eight experimental conditions following a 2 (Formal forecast: drought versus rain)  $\times$  2 (Informal confirmation of the forecast: confirmed versus not confirmed)  $\times$  2 (Presence of incentive: present versus not present) within subjects repeated measures design were used. The three market orientation components (customer orientation, competitor orientation, and interfunctional coordination), and the two control variables (market interaction, and other income) are measured directly.

### *3.3 Procedure*

Respondents rated eight scenarios; first the four drought scenarios and then four rain scenarios. The scenarios were read to subjects one by one and immediately after each scenario respondents answered questions on herd size change given that scenario (see Appendix 1 for an example scenario). Formal forecast was manipulated by stating that government workers and NGOs working in the area of the pastoralists predicted a specific climatic condition (prolonged drought or rain). The scenario also read the consequences of these conditions in terms of the availability of pasture and water and the consequences that the state of these resources are likely to have on the herd (that animals may become weak, thin, poor in quality and possibly even die in times of drought, or that the resources are suitable for breeding, and fattening or to make it attractive for the market and potentially sell at higher prices).

*Manipulation of informal confirmation of the forecast.* In conditions where the informal forecast (from the traditional knowledge system) confirms the formal forecast, it was read to

pastoralists that the formal forecast provided by government agents and NGOs, is confirmed by wise-men so-called *Hayyuu* in their community. In the remaining conditions it was read that the formal forecast is disconfirmed by wise-men.

*Manipulation of presence of incentive:* In conditions with the presence of incentive, it was read to pastoralists that a quality certification bureau established by exporters in their market, would grade the livestock quality that they offer to the market. The quality grading is made for free on request of pastoralists. The quality certification bureau will grade livestock either as top quality, medium quality or poor quality. It was also read that the quality certificate can help pastoralists improve the quality of their livestock and bargaining power to get higher prices. In the remaining conditions it was read to the pastoralists that there is no quality certification bureau to grade the livestock quality that they offer to the market.

### 3.4 Data collection

*3.4.1 Study context and selection.* Ethiopia has the largest number of pastoralists in the Horn of Africa, which contains the largest population of pastoralists in the world (ECHO, 2007). Ethiopia alone hosts more than 12 million pastoralists (Getahun, 2008). Within Ethiopia, substantial differences distinguish the pastoralists in terms of climate, vegetation, and geographic location (Unruh, 2005). In Ethiopia, we selected the Yabello in the southern Borana area and Kereyu Fentale (hereafter, Fentale) in the Rift Valley, because they jointly represent sufficient variation on these characteristics.

*3.4.2 Questionnaire development and pretesting.* We designed a survey questionnaire in English which we then discussed with an expert with field research experience in the two geographic areas for feedback. After incorporating his suggestions, we asked a certified translator to Oromiffa, the local language spoken in both areas, to translate the English questionnaire. Another translator then translated the questionnaire back to English, to verify the correct interpretation of the questions.

We used the services of five professional enumerators in each district (10 total) to pretest and collect the data. All enumerators were professionally involved in working with the pastoralists; they are assigned to maintain relationships between the pastoralists and local governments. They all lived in the area of the data collection, shared cultural backgrounds and languages with the respondents, and had completed tertiary education levels. These enumerators received five days of training about the data collection. After the training, they

conducted two rounds of questionnaire pretesting in which they interviewed a total of 12 pastoralists (two rounds of three respondents in each area).

*3.4.3 Sample and interview procedure.* Because the two selected areas are very large (Fentale is 1,169 km<sup>2</sup>, Yabello is 5,523 km<sup>2</sup>), we selected specific strata to prevent systematic biases and sampled pastoralists on a convenience basis, carried out as randomly as possible within these strata. Using insights from our prestudy, strata varied in terms of distance to the main road, occurrence of additional activities for income (like farming), and conflicts with formal sector activities (like plantations being established in areas that are traditionally used for grazing). As confirmed by local enumerators, we chose four research sites in each area. Because we had no information that the strata are considerably different in terms of size in the populations, the number of respondents sampled from each stratum is about equal.

Most pastoralists are low-literate, so written scale items in a questionnaire may be confusing. Therefore, we replaced a traditional five-point Likert-type scale with five sticks of increasing worth, such that stick 5 is worth five times as much as stick 1. For multi-item questions of the market orientation components: customer orientation, competitor orientation, and interfunctional coordination, pastoralists responded by picking sticks (stick 1 = “strongly disagree,” stick 5 = “strongly agree”). To ensure that respondents understood the procedure of using sticks, they practiced before the start of the interviews.

### *3.5 Operationalization and measurement*

To measure the dependent variable, pastoralists were asked to rate their intended herd size change for camels, cattle, goats, and sheep (for each livestock type). Pastoralists' are reluctant to share precise livestock numbers, because, in their culture, sharing these numbers is often seen as bringing bad luck (e.g., Dahl & Hjort, 1976; Sperling, 1987; Gefu, 1992). We therefore used Likert-type scales to measure intended herd size change. We extended our five sticks to an eleven point scale to get a response from pastoralists on their intended herd size change. Pastoralists therefore rated their intended herd size change using 11 point Likert type scale (-5= most likely to decrease, +5= most likely to increase). If a pastoralist intends to decrease, for example a cattle, then he was asked by how much (5= high decrease, 1= low decrease; we represent high decrease as -5 and low decrease as -1). Similarly, if a pastoralist responds to increase a herd, then he was asked by how much (5= high increase, 1= low increase; we represent high increase as +5 and low increase as +1). If a pastoralist responds as no change in herd size for a specific scenario, we represent by a zero.

Next, we converted the scores of camels, cattle, goats and sheep into Tropical Livestock Unit (TLU). TLU (250 kg live weight) is used as a common unit to describe livestock numbers of various species present in the rangeland (Janhke, 1982). We converted the responses of pastoralists for camels, cattle, goats, and sheep by multiplying them by respective TLU conversion factors (Davies & Bennett, 2007; Janhke, 1982)<sup>1</sup>. Then, we summed up the four livestock types to form an index for intended herd size change.

Following Narver and Slater (1990), we used multi-item measures for the three market orientation components: customer orientation, competitor orientation, and interfunctional coordination. To validate the multi-item measures for the three components of market orientation, we used conventional methods, including exploratory factor analysis and Cronbach's alpha (Churchill, 1979), and dropped any items that loaded on multiple factors and/or had low loadings.

After purification, we measured customer orientation with five items that refer to practices valued by buyers, such as improved breeding (alpha = .86). These items jointly reflect doing business based on understanding customers and satisfying their needs by creating customer value, as in Narver and Slater's (1990) original scale. Competitor orientation is measured by four items pertaining to the collection of and response to information about other suppliers in the livestock market (alpha = .77). For interfunctional coordination, we use five items related to collaboration and information sharing with other actors in the network (alpha = .79). For the scale items, factor loadings and Cronbach's Alpha's we refer to the appendix 2.

Our analysis also includes two control variables, market interaction and other income. We measured market interaction by the number of livestock sold and bought by pastoralists within one year (e.g., Jaleta & Gebremedhin, 2011). We measure other income by using a dummy variable (1= engaged also in other activities, 0= engaged in livestock production only). Table 1 shows means, standard deviations, and correlations for measured variables.

**Table 1.** Means, standard deviations, and correlations for measured variables

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<sup>1</sup> In range ecology, TLU is a measure of tropical ruminant forage demand as well as grazing pressure (on the resources) for different livestock types (Le Houerou 1989; Turner, et al., 2005). It therefore measures herd size in terms of burden for the natural resources (pasture and water). TLU conversion factors for matured livestock is for a camel = 1, for a cow = 0.7, for a goat or sheep = 0.1 (Davies & Bennett, 2007; Jahnke, 1982).

<i>Variables</i>	<i>Mean</i>	<i>SD</i>	1	2	3	4	5	6
1 Customer orientation	3.01	1.09	1					
2 Competitor orientation	3.67	.98	.49 <sup>a</sup>	1				
3 Interfunctional coordination	1.77	.78	.17 <sup>a</sup>	.14 <sup>a</sup>	1			
4 Market interaction	21.59	15.58	.15 <sup>a</sup>	.14 <sup>a</sup>	.03	1		
5 Other income	.59	.49	.24 <sup>a</sup>	.46 <sup>a</sup>	.25 <sup>a</sup>	.08 <sup>a</sup>	1	
6 Total herd size change (in TLU)	1.42	3.40	.03	-.03	-.02	.07 <sup>a</sup>	-.04	1

<sup>a</sup> p < .01 two tailed significance

Note: Correlation between total herd size change and manipulated variables is -.53 for formal forecast, -.08, informal confirmation of the forecast, and .02 presence of incentive, respectively. Correlation coefficients between the manipulated variables as well as with other measured variables are zero.

### 3.6 Data analysis

We test our hypotheses using a regression model, which may ease the interpretation of the complex interaction terms of continuous and manipulated variables as compared to repeated measures analyses of variance (e.g., Aiken & West 1991). We use an effects coding scheme (Bech & Gyrd-Hansen, 2005; Cohen & Cohen, 1983) for manipulated variables, coding the first level as + 1 and the second level as -1. Using effects coding is preferred to dummy coding to estimate unbiased parameter for constant term of a regression model (Bech & Gyrd-Hansen, 2005). The model can be specified as:

$$Y = \beta_0 + \beta_1D1 + \beta_2D2 + \beta_3D3 + \beta_4D4 + \beta_5X1 + \beta_6X2 + \beta_7X3 + \beta_8X4 + \beta_9X5 + \beta_{10}X6 + \beta_{11}X7 + \beta_{12}X8 + \beta_{13}X9 + \beta_{14}X10 + \beta_{15}X11 + \beta_{16}X12 + \beta_{17}X13 + \beta_{18}X14 + \epsilon,$$

where Y is the intended herd size change (dependent variable);  $\beta_s$  are the parameter estimates; D1 and D2 are respectively variables for formal forecast (coded as +1 for drought and as -1 for rain), informal confirmation of the formal forecast (coded as +1 for confirmation and as -1 for disconfirmation). X1–X3 denote customer orientation, competitor orientation, and interfunctional coordination, respectively. In turn, D3 represents the control variable on the presence of incentive (coded as 1 for present and as -1 for absent), D4 corresponds to the control dummy variable on other income (coded as 1 when the respondent has also other sources of income and coded as 0 when the responded relied for his income only on the

livestock); X4 corresponds to the control variable on market interaction. X5 is the interaction of formal forecast and informal confirmation of the forecast; X6-X8 the two-way interactions of formal forecast and the three market orientation components; X9-X11 the two way interactions of informal confirmation of the forecast and the market orientation components; and X12-X14 the three way interactions of formal forecast, informal confirmation of the forecast and the market orientation components.

Because our respondents are included eight times in the data set (once for each experimental condition), we subtracted the mean of the respondent over all eight conditions from their scores on the dependent variable, intended herd size change. This is recommended to remove potential biases caused by the repeated measures design for the field experiment (e.g., Schaninger & Buss, 1986; Cleaver & Wedel, 2001). Except for the manipulated variables and a dummy (control) variable, we mean centered the independent variables before inputting them (Aiken & West, 1991). We inspected our findings for multicollinearity. The highest variance inflation factor in our models was 1.560 for competitor orientation; thus multicollinearity is unlikely to be a problem in our analyses (e.g., Hair et al., 1995).

In addition, we ease the interpretation of the findings by running regression models for specific experimental conditions, i.e., one on the experimental conditions for drought, and one on the experimental conditions for rain. The results of the full model and these models on rain and drought respectively can be found in Table 2. Next, we split these models further in specific models for confirmation and disconfirmation within the rain and drought conditions. The results of these models can be found in Table 3. This approach eases the interpretation because the potential number of interactions is reduced without changing the estimates other than possible rounding differences (Aiken & West, 1991).

## 4. Results

### 4.1 Hypotheses testing

Hypothesis 1 predicted that rain forecasts would lead pastoralists to increase their herd size and that drought would let them to decrease the herd size. This hypothesis is supported since the effect of formal forecast in the full model is significant (-1.79,  $p < .01$ ). The direction of the parameter is as expected, as can be found in the separate models for rain and drought in Table 2. The constant in the model with the rain condition is positive (1.75,  $p < .01$ ) suggesting an increase of the herd size, while the constant in the model for drought is negative (-1.75,  $p < .01$ ) suggesting a decrease of the herd size.

Hypothesis 2 suggested that a confirmation of the formal forecast by informal forecasting techniques would strengthen the effect of the formal forecast on the intended herd size change. This hypothesis is supported because the parameter for the interaction between formal forecast and informal forecast confirmation of the forecast in the full model is significant ( $-.66, p < .01$ ) and because confirmation of the formal forecast leads indeed to a herd size increase in the rain condition ( $.92, p < .01$ ) and a decrease in the drought condition ( $-.41, p < .01$ ).

Hypothesis 3 suggests that the effect of the formal forecast is also strengthened by the market orientation components. Hypotheses 3a on customer orientation and 3c on interfunctional coordination are in that respect supported. In the full model the interaction effects of formal forecast and customer orientation ( $-.15, p < .01$ ), as well as interfunctional coordination ( $-.29, p < .01$ ) are significant. In the rain and drought conditions, these effects are also significant and in the expected directions ( $.14, p < .1$  and  $-.14, p < .05$  for customer orientation in the rain and drought models respectively, as well as  $.29, p < .01$  and  $-.29, p < .01$  for interfunctional coordination). Hypothesis 3b on competitor orientation shows however an opposite effect. The effect in the full model is significant, but its direction is opposite to the effects of customer orientation and interfunctional coordination ( $.20, p < .01$ ). Thus, Hypothesis 3b is rejected. A closer look in the models on rain and drought, show that competitor orientation weakens the decrease of the herd size in the drought condition ( $.22, p < .01$ ), and weakens the increase of the herd size in the rain condition ( $-.22, p < .05$ ). We will return to this finding in the discussion section.

Hypothesis 4 suggests that the role of market orientation is strengthened when the formal forecast is disconfirmed by the informal forecast. This hypothesis is partially supported. In the full model, the three-way interaction effects of formal forecast, informal confirmation of the forecast and customer orientation ( $.10, p < .05$ ) as well as interfunctional coordination ( $.13, p < .05$ ) are significant, but the effect with competitor orientation is not ( $-.06, p > .1$ ). The models on rain and drought (Table 2) suggest that these effects can be ascribed to the rain condition because the two-way interactions of the informal confirmation of the forecast and customer orientation ( $-.14, p < .1$  for rain and  $.06, p > .1$  for drought) as well as interfunctional coordination ( $-.24, p < .05$  for rain and  $.02, p > .1$  for drought) are significant in the rain condition only. The results reported in Table 3 in the model on rain and disconfirmation of the formal forecast, subsequently show that these effects are in the

predicted direction, i.e., that customer orientation (.29,  $p < .05$ ) as well as interfunctional coordination (.53,  $p < .01$ ) both strengthen the increase in herd size.

#### *4.2 Other results*

The results in the full model show a significant direct effect of informal confirmation of the formal forecast (.25,  $p < .01$ ) that was not predicted by the hypotheses. This effect suggests that pastoralists may also respond directly to the recommendations of their wise men, regardless of the predictions by formal forecasts. This finding confirms previous studies that concluded that traditional institutions are influential among pastoralists in East Africa (e.g., Swift, 1991; Mwangi & Ostrom, 2009).

In addition to the hypothesized relationships, we find no significant effect on the control variable presence of an incentive. It is noteworthy to mention that we tested our models with additional two-way and three-way interaction effects including presence of incentive and any other combination of the substantive variables in our study. None of the effects was significant. This reaffirms that the benefits provided by a market orientation can't be copied by providing economic incentives. Also the controls on other income and market interaction are not significant in the full model. Market interaction is however significant in the drought model (-2.05,  $p < .01$ ). According to the results in Table 3, it helps to decrease the herd size in a drought condition that is confirmed by the informal forecast (-.02,  $p < .01$ ). In the drought condition with confirmation by the informal forecast, the impact of the market orientation components is also relatively weak, suggesting that if there is little uncertainty about the drought forecast, market orientation is not really necessary to adapt but mere interaction with the market (either with a market-oriented mindset or not) is enough to foster adaptation.

**Table 2.** Unstandardized regression coefficients for the relationship between market orientation components, formal forecast, and informal confirmation of the forecast on changes in the intended herd size

Variable	Full model		Rain		Drought	
	B	t-value	B	t-value	B	t-value
(Constant)	0.00	0.00	1.75 <sup>a</sup>	13.44	-1.75 <sup>a</sup>	-18.03
Formal forecast	-1.79 <sup>a</sup>	-37.40				
Informal confirmation of the forecast	0.25 <sup>a</sup>	5.31	0.92 <sup>a</sup>	11.97	-0.41 <sup>a</sup>	-7.16
Customer orientation	0.00	0.00	0.14 <sup>c</sup>	1.66	-0.14 <sup>b</sup>	-2.22
Competitor orientation	0.00	0.00	-0.22 <sup>b</sup>	-2.27	0.22 <sup>a</sup>	3.05
Interfunctional coordination	0.00	0.00	0.29 <sup>a</sup>	2.86	-0.29 <sup>a</sup>	-3.84
<i>Two-way interaction terms</i>						
Formal forecast × informal confirmation of the forecast	-0.66 <sup>a</sup>	-13.86				
Formal forecast × customer orientation	-0.15 <sup>a</sup>	-2.91				
Formal forecast × competitor orientation	0.20 <sup>a</sup>	3.55				
Formal forecast × interfunctional coordination	-0.29 <sup>a</sup>	-4.71				
Informal confirmation of the forecast × customer orientation	-0.04	-0.79	-0.14 <sup>c</sup>	-1.72	0.06	0.99

Table 2. (continued)

Variable	Full model		Rain		Drought	
	B	t-value	B	t-value	B	t-value
Informal confirmation of the forecast × competitor orientation	0.01	0.14	0.07	0.76	-0.05	-0.78
Informal confirmation of the forecast × interfunctional coordination	-0.11 <sup>c</sup>	-1.74	-0.24 <sup>b</sup>	-2.40	0.02	0.29
<i>Three-way interaction terms</i>						
Formal × informal confirmation of the forecast × customer orientation	-0.10 <sup>b</sup>	-1.97				
Formal × informal confirmation of the forecast × competitor orientation	0.06	1.08				
Formal × informal confirmation of the forecast × interfunctional coordination	-0.13 <sup>b</sup>	-2.09				
<i>Control variables</i>						
Presence of incentive	0.05	1.08	0.10	1.24	0.01	0.16
Other income	0.00	0.00	0.07	0.38	-0.07	-0.51
Market interaction	0.00	0.00	0.01	1.53	-0.01 <sup>b</sup>	-2.05
F-statistics (df), significance	F(18, 1837), 92.75 <sup>a</sup>		F(10, 917), 17.24 <sup>a</sup>		F(10, 917), 8.33 <sup>a</sup>	
R <sup>2</sup> (Adj.R <sup>2</sup> )	.48 (.47)		.16 (.15)		.08 (.07)	

<sup>a</sup> p < .01, <sup>b</sup> p < .05, <sup>c</sup> p < .1 two-tailed significance

**5. Discussion**

In this study the role of marketing in enhancing the adaptation of pastoralists to the changing climatic conditions (i.e., drought versus rain) is analyzed. To this respect, the study examined the extent to which market orientation (an incentive for self-enhancement) contributes to pastoralists’ adaptation to the changing climatic conditions. To do so, we tested the effects of customer orientation, competitor orientation, and interfunctional coordination on the relationship between formal forecast and the intended herd size change. In addition we also tested informal confirmation of the forecast and its interaction with market orientation on their influence to the relationship of formal forecast and the intended herd size change. The findings are summarized in Table 4. Note that in Table 4 + (-) refers to a factor that stimulates (weakens) responsiveness to an announced change in climatic conditions and not to an increase or decrease of the herd size. We discuss the findings below.

**Table 4.** Factors that strengthen or weaken the response to an announced change in climatic conditions

<b>Formal forecast</b>	<b>Formal forecast is confirmed by the informal forecast</b>	<b>Formal forecast is disconfirmed by the informal forecast</b>
Predicted rain		Customer orientation (+) Interfunctional coordination (+) Competitor orientation (-)
Predicted drought	Market interaction (+) Interfunctional coordination (+)	Customer orientation (+) Interfunctional coordination (+) Competitor orientation (-)

As predicted in hypothesis 4, we expected that the effects of market orientation would be stronger when the climate forecast is disconfirmed by the informal forecast techniques of pastoralists themselves. We predicted that competitor orientation would, just like customer orientation and interfunctional coordination, increase the cooperation of pastoralists in the resource dilemma that they face when they are informed about an upcoming drought. Surprisingly, the results show an opposite effect, meaning that when pastoralists should sell in order to preserve natural resources, they will increase their herd (or at least decrease less) and

when they can increase the herd because rain is predicted, they will sell (or increase less). This indicates that a higher competitor orientation of pastoralists increases speculative behavior in that they use the expected drought for personal gains. As such, competitor orientation has a detrimental effect on sustainable resource utilization by pastoralists. This conclusion casts further doubt about whether a competitor orientation is a valid component of a market orientation. Apparently, it does not contribute to long-term value creation, but rather to short term speculation. In that respect our study adds to previous findings that questioned the role of competitor orientation in innovativeness and business performance (e.g., Frambach et al., 2003; Ingenbleek, Frambach, & Verhallen, 2010; Tessema et al., 2012; Voss & Voss, 2000).

When formal forecasts are confirmed by informal forecasts, thus creating a relative certainty for pastoralists with regard to the expected climatic conditions, the effects of market orientation are not significant (except for interfunctional coordination when drought is predicted). In a situation where drought forecast is confirmed by the informal forecasting technique, the control variable market interaction showed a significant effect. Apparently, in this situation market interaction is in itself a sufficient condition to ensure that pastoralists respond. In other words: the only pastoralists that will not respond are those that don't interact with markets, for examples because they are too far away from the nearest market or are refrained from contacts with potential buyers (or brokers that can connect them to those buyers). When drought is predicted, the urgency to respond is much higher than when rain is predicted. The significant effect of interfunctional coordination in the drought model with confirmation can therefore be explained from the fact that interfunctional coordination taps the network contacts that pastoralists have with brokers and other people that can facilitate a fast, efficient and profitable exchange.

Finally, we should discuss the findings on the presence of an incentive, which showed no influence on intended herd size change in any of the conditions. For a condition in which drought is confirmed, this is logically explained by the other finding showing that access to markets without further intrinsic or extrinsic motivation is enough for pastoralists to respond. However, the findings in the conditions where the formal climate forecast is disconfirmed are more remarkable. In these conditions, customer orientation and interfunctional coordination, representing factors that contain intrinsic motivations to respond have a significant effect. Adding an external motivation in the form of an incentive, that strengthens pastoralists' negotiation

position on the market, doesn't make a significant contribution to the responsiveness of pastoralists to predicted changes in climatic conditions. This finding suggests that providing economic incentives alone without facilitating pastoralists' intrinsic motivation will not help to enhance their adaptation to the changing climatic conditions. This emphasizes that market orientation (as customer orientation and interfunctional coordination) strengthens the response to a resource dilemmas because it combines the economic benefits with an intrinsic motivation to respond that can't be replaced by an external incentive.

## **6. Policy implications, limitations, and direction for further research**

### *6.1 Policy implications*

The findings of this study have several implications for policy makers that aim to strengthen the responsiveness of pastoralists to climatic forecasts. In order to do so, policy makers should first integrate formal and informal forecasts. Pastoralists appear highly responsive when the formal forecasts on changes in climatic conditions are confirmed by pastoralists' own informal forecasts. Policy makers must make sure that forecast information from the formal and informal sources are aligned as much as possible. To this respect, it is crucial to bring people together that provide the formal and informal forecasts. This may require a mechanism, such as a forum that brings together "formal" meteorologists and "informal" wise-men, to reconcile when there is contradictory forecast information from the two sources to pastoralists.

However, even if pastoralists receive unambiguous messages from different sources, they should be enabled to respond by the availability of and access to markets where they can sell and buy livestock. Weak markets and market institutions can limit the market integration and thus adaptation of pastoralists to the changing climatic conditions (e.g., Verbeke et al., 2009). According to McPeak (2005), difficulties to find a sufficient and affordable supply of good quality livestock on the market to restock during rain, are the main reasons for limited destocking during drought. Thus, policy makers need to alleviate the constraints that arise from weak markets to facilitate both the destocking and restocking.

Next, although an alignment of formal and informal forecasts is important, it is unlikely that a complete integration of the different sources will be achieved in the near future. As a consequence, policy makers should be prepared that pastoralists will often remain confronted with contradicting information, thus creating uncertainty. Our study showed that in these

conditions, market orientation becomes particularly important to foster adaptation to changing climatic conditions. Policy makers should therefore support and encourage pastoralists to enhance customer orientation and interfunctional coordination (hereafter referred to a market orientation, thus excluding competitor orientation). A proactive approach based on pastoralists' intrinsic self-enhancement motivation, i.e., market orientation helps to sustain livestock production by pastoralists; as it helps to minimize livestock losses due to the drought. Pastoralists with higher market orientation raise livestock of better breeds (and fatten livestock that they want to sell). This enables them to sell more easily before droughts than other pastoralists with lower market orientation. Thus, policy makers need to strengthen and support pastoralists' marketing practice as a competence to adapt to the changing climatic conditions by changing their herd size. To this respect, policy may focus on measures that facilitate the sharing of market knowledge (like a mobile phone network) and measures that improve the responsiveness of pastoralists to that market knowledge like training in fattening and experience sharing with fattening operators, or other pastoralists. Stimulating the development of customer orientation and interfunctional coordination seems almost inevitable for policy makers as the presence of an incentive in the market (by an outside party), is not necessarily a factor to influence responsiveness to changes in climatic conditions.

### *6.2 Limitations and direction for further research*

The research approach that we have taken here is not without its limitation. The study tests the relationship of market orientation components, and the formal forecast and the informal confirmation of the forecast on the intended herd size change. Though significant results are shown, the study is based on a semi-experimental design in which the dependent variable is based on cross-sectional data on intended herd size change rather than the actual herd size change. The external validity of the findings would benefit from a longitudinal study that measures the actual herd size change of pastoralists. To this respect, conducting research on a panel of pastoralists immediately after the rain and after the dry period for several time periods further increases our insights in the relationship between the market orientation and actual herd size change.

Though the study shows the first empirical evidence on the market orientation's contribution to the sustainable utilization of the natural resources, its relevance beyond the pastoralists' context is not yet tested. This may limit the generalizability of the findings to other

smallholder agricultural producers. Thus, research also might analyze relationship between market orientation and adaptation to the changes in climatic conditions to other smallholder agricultural producers beyond the pastoralists' context. To this respect, research might test how market orientation of smallholder agricultural producers (e.g., crop farmers) influences their adaptation to the changes in climatic conditions through changes in their crop varieties, timing of planting, and diversification.

## **7. Conclusion**

This study shows that market orientation enhances the adaptation of pastoralists in terms of herd size change to the changes in climatic conditions. The two components of market orientation: customer orientation and interfunctional coordination increase the adaptation of pastoralists in intended herd size change due to formal forecast about the changing climatic conditions. Further, the study shows that market orientation strongly influences the relationship between formal forecast and the intended herd size when there is disconfirmation of the formal forecast by the informal. When the drought forecast is confirmed by the informal forecast, the study shows that market interaction by itself is a sufficient condition for pastoralists to respond to the predicted climatic condition. The study also shows that integrating the formal and informal confirmation of the forecasts enhances pastoralists' response in terms of changing their herd size.

In conclusion, the present study shows that, given the availability and access to markets by pastoralists, marketing can play a role in the sustainable utilization of the natural resources such as pasture and water by pastoralists. Pastoralists with higher market orientation will destock before droughts and restock when there is rain. Pastoralists with higher market orientation therefore change their herd size by adapting to the availability of pasture and water. This in turn helps them to manage effectively their pasture and water from overexploitation. Thus, there should be a policy support that facilitates the sharing of market knowledge and measures that improve the responsiveness of pastoralists to that market knowledge to enhance market orientation of pastoralists. From the domain of the public policy there is therefore a unique contribution of market orientation to manage resource dilemma situation of pastoralists, because external incentive without the intrinsic motivation of pastoralists does not help to the adaptation of pastoralist to the changing climatic conditions. Thus, market orientation helps to solve

Hardin's (1968) classic resource dilemma of pastoralists because enhanced market orientation by pastoralists facilitates their effective destocking and restocking of livestock depending on the ecological conditions.

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**Appendix 1.** Description and an example of scenarios

The following descriptions are imaginary future scenarios. We are going to ask you about your decision to decrease or increase different types of your livestock. ‘There are two scenarios in this part of the questionnaire: “occurrence of drought” and “occurrence of rain for sufficient pasture and water” in the coming year. The drought will cause degradation and scarcity to pasture and water for your livestock. Because of the drought, your livestock may become weak, thin and poor in quality; and they may even die. On the other hand, occurrence of rain will help you to breed your livestock to increase the herd size. You can also make your livestock fat and attractive to sell at higher price in the market.

In both scenarios, there is **information from experts** regarding the occurrence of drought and rain. The information of experts could sometimes be confirmed but other times not **confirmed by the wise-men (Hayyuu)** in your area (village). The **quality certificate** issuing bureau could be present sometimes and another times not present. Please check carefully which of the above elements are available in each part of the scenario to make your decision either to decrease, increase or not to take any action on your herd size.

**Condition 1:** Imagine that experts from the Government and NGOs working in your area say that prolonged drought is going to occur in the next year. The drought will cause degradation and scarcity to pasture and water for your livestock. Wise-men from your community with whom you discussed this issue confirm that this indeed will happen. Because of the drought, your livestock may become weak, thin and poor in quality; and they may even die. Except for this drought you should not consider other significant changes. Exporters are not involved in your market to establish quality certification bureau.

Please indicate to what extent you are likely to decrease or increase different types of your livestock?

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Cattle

Most likely to decrease -5 -4 -3 -2 -1 0 + 1 + 2 + 3 + 4 + 5 Most likely to increase

Camels

Most likely to decrease -5 -4 -3 -2 -1 0 + 1 + 2 + 3 + 4 + 5 Most likely to increase

Goats

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Most likely to decrease -5 -4 -3 -2 -1 0 + 1 + 2 + 3 + 4 + 5 Most likely to increase

Sheep

Most likely to decrease -5 -4 -3 -2 -1 0 + 1 + 2 + 3 + 4 + 5 Most likely to increase

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**Appendix 2** Construct items, loadings, and alpha values

<b>Item</b>	<b>Customer orientation (alpha = .86, eigenvalue = 3.18)</b>	<b>Factor loadings</b>
1	We do nothing to increase the quality of our livestock that we want to sell. (R)	.76
2	We increase the quality of our livestock that we are planning to sell in the market.	.88
3	We breed with livestock that will give us the quality traders are looking for.	.83
4	We always prefer to keep the best livestock for ourselves. (R)	Dropped
5	We sell our livestock only when we could not get income from other sources. (R)	Dropped
6	We raise livestock that the market wants.	.70
7	We always search for better breeds to satisfy traders and exporters.	.81

<b>Item</b>	<b>Competitor orientation (alpha = .77, eigenvalue = 2.63)</b>	<b>Factor loading</b>
1	What other livestock suppliers are doing in the market does not bother to me. (R)	.77
2	We always check what other livestock suppliers are doing on the market.	.69
3	Knowing the livestock type that others are supplying to the market is important to us.	Dropped
4	We always decrease or increase our market price following other suppliers.	.76
5	We are not interested in what other pastoralists are doing in the market. (R)	.65

<b>Item</b>	<b>Interfunctional coordination (alpha = .79 , eigenvalue = 2.85)</b>	<b>Factor loadings</b>
1	Our broker will tell us when prices for our livestock are good.	.78
2	We collaborate very closely with our broker.	.88
3	Our broker advises us for best breed and fattening to increase quality of our livestock.	.76
4	Brokers withhold important market information from us. (R)	.62
5	We talk to community members on how to improve the quality of our livestock.	Dropped
6	We exchange information in the community before going to the market.	Dropped
7	We always contact knowledgeable people (e.g., experts) for market information.	.72

<b>Item</b>	<b>Rainfall (alpha = .78, eigenvalue = 2.89)</b>	<b>Factor loading</b>
1	We can rely on the rain.	.69
2	Rain comes always as we expected.	.72
3	These days rain is not coming as we expected. (R)	.70
4	Unexpected droughts may happen to us. (R)	Dropped
5	Rain always comes at the same time of the year.	.63
6	We assumed that rain would come but it didn't. (R)	.67
7	We are getting less rain fall than we expected. (R)	.75