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Information sharing and its integrative role

An empirical study of the malt barley value chain in Ethiopia

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Abstract

Purpose – The purpose of this paper is to describe the volume and quality of information and communication channel use at various stages of the malt barley value chain (MBVC) in Ethiopia and to investigate how metrics of these variables influence the extent of integration of the chain.

Design/methodology/approach – The study is based on survey data collected from 320 farmers and 100 traders and interview responses compiled from 76 respondents. Descriptive statistics and ordered logistic regression were used for data analysis.

Findings – The descriptive statistics show a lower volume and poor quality of information is being shared at farmer-trader interface and that value chain integration (VCI) is weak at all studied interfaces. Results of ordered logistic regression show that information volume and quality positively influence VCI, whereas a positive relationship between channel use and VCI was found only at farm level interfaces. Evidences found suggested that inconsistent information systems, lack of information sharing plans, low level of members' awareness about the value of information, and lack of trust to share information were factors that inhibited information sharing in the MBVC.

Originality/value – The study offers pioneering evidence of the relative role of information volume and quality and channel use as factors that influence the extent of integration of the value chain.

Keywords Ethiopia, Information sharing, Agribusiness value chain, Value chain integration

Paper type Research paper

1. Introduction and objectives

Information sharing helps value chain members to align operational and strategic plans (Holweg *et al.*, 2005). Value chain members can improve their own and chain's performance through collaborations based on resource, capability and risk sharing (Munyua and Stilwell, 2013); and coordination of activities across the value chain (Bagchi and Skjoett-Larsen, 2003) which can materialize through information sharing. Past studies have noted a positive association between information sharing and value

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chain integration (VCI) (Vickery *et al.*, 2003; Munyua and Stilwell, 2013). In this study, VCI is conceptualized to mean collaboration among members by way of resource, capabilities and risk sharing, commitments toward long-term relationships, and coordination of activities and decisions along the value chain.

Review of the salient literature on information sharing along the value chain revealed a number of gaps. First, metrics of information sharing as conceptual constructs such as information volume, information quality and channel use were not considered in previous studies (Handfield and Bechtel, 2002; Vanpoucke, 2009), rather information sharing was considered as a single variable. Second, information sharing was considered either as an indicator of VCI (Moberg *et al.*, 2002; Pandey *et al.*, 2010) or as an antecedent of value chain performance (Malhotra *et al.*, 2005; Hartono *et al.*, 2010; Wiengarten *et al.*, 2010; Wu *et al.*, 2014). The integrative role of information sharing was not investigated. Third, information sharing in the context of agribusiness sector where product characteristics and business conditions are complex and limited by various barriers was not given adequate attention (Lazzarini *et al.*, 2001). Fourth, most past studies on information sharing in agribusiness value chains are dyadic ones and were not chain-level studies (Giunipero *et al.*, 2008; Bastl *et al.*, 2012).

The study, therefore, aims to: conceptualize the multi-dimensional aspects of information sharing and VCI; identify barriers to information sharing along the malt barley value chain (MBVC); measure levels of information volume and quality, channel use and VCI; and investigate the interplays between the multidimensional concepts of information sharing and VCI using empirical data obtained from the MBVC in Ethiopia.

The MBVC was chosen as an interesting case to study due to its substantial capacity, breadth of engagement of large numbers of members at most chain stages, high socio-economic importance, and significant contribution to the national economy. According to the data obtained from the Assela malt factory (AMF), half a million small-scale farmers, hundreds of traders, tens of cooperatives, a single malt factory and four breweries which are full subsidiaries of multinational beverage companies participate in the chain to add values of varying magnitude from malt barley production till its conversion to beer. Available statistics indicate that 420,000 metric tons of malt barley is produced annually. Nonetheless, this production and its vertical progress through processing is known to be constrained in a number of ways, the malt factory frequently facing short supply of adequate quality malt barley. This condition is especially surprising and suggests the extent of poor functioning of the supply chain given that the malt factory's annual demand is only 50,000 metric tons. This misalignment between demand and supply is known to be influenced by poor post-harvest and delivery systems along the supply chain. Presently, breweries can only meet 40 percent of their malt requirements from the single malt factory in the chain. The level of information sharing along the chain in terms of its volume and quality, and channel use are central methods to achieve VCI. Therefore, this empirical investigation aims to draw important policy recommendation regarding information sharing between value chain members and VCI.

The structure of the paper is as follows. In the next section, we provide a theoretical framework for the study. In Section 3, the research methodology is thoroughly described. In Section 4, relevant data are analyzed and key results are discussed. Section 5 provides conclusions and indicates practical implications.

2. Theoretical background and conceptual framework

Information sharing along the value chain improves members' knowledge, reduces search costs, and leads to convergent forecasts (Li and Lin, 2006; Wever *et al.*, 2009;

Wu *et al.*, 2014). As noted by Vanpoucke *et al.* (2009), information sharing is a key contributing mode for achieving VCI. For example, stock-outs and stock-repetition can be avoided when value chain members share information on inventory balances (Kulp *et al.*, 2004; Lotfi *et al.*, 2013). Information sharing on consumer demand improves order fulfillment performance. Likewise, information sharing on new products enables on-time delivery of the required inputs for its production.

In their past studies, Ketzenberg (2009) and Li and Lin (2006) argue that information sharing leads to strong VCI through informing members about needs of their chain partners. When appropriate volume and quality information is shared between members, activities along the value chains can easily be coordinated. Moreover, information sharing creates conducive environment for members' collaboration (Bagchi and Skjoett-Larsen, 2003). In contrast, value chain members could intentionally hold information in hopes of exploiting it for their firm's singular benefit, personal opportunism (Bagchi and Skjoett-Larsen, 2003). In such a case, focal value chain members should motivate other members to freely share information with their value chain partners.

2.1 Multidimensional characteristics of information

In the context of value chains, information sharing refers to the exchange of knowledge between its members (Vanpoucke, 2009). For example, this knowledge might include information on production or operation capacities, plans and goals, product and service specifications, prices and demands, inventory balances, or contemplated changes. The strength of VCI improves when mid-stream members transfer demand and delivery information upstream and downstream the value chain. In this study, we identified information volume, information quality and channel use as key multidimensional characteristics of information shared along the value chain. Information volume is defined as types and level of details of the information shared to inform value chain partners about own activities, processes and plans (Handfield and Bechtel, 2002).

In this study, information volume is conceptualized to mean the breadth (i.e. varieties) and depth (i.e. details) of information being shared between value chain members to enhance the knowledge about partners' operations. In the views of Pandey *et al.* (2010), Weaver (2010) and Lotfi *et al.* (2013), for example, information on demand and price forecasts, inventory balances, production and procurement plans, current capacities and expansion plans, and sales and purchase orders are important, if shared. On the other hand, information depth refers to whether the information shared contains all necessary details to enhance chain partner performance of particular tasks (Weaver, 2010). Information volume can be minimal or zero when value chain members do not share any type of information and high when they are transparent to one another (Sahin and Robinson, 2002). Though the influence of information volume on VCI has not been studied, Handfield and Bechtel (2002) empirically showed a concave (inverted U) functional relationship between information volume and decision effectiveness. That is to associate poor decision effectiveness with less information volume on one extreme as well as with information overload on the other extreme.

Information quality refers to the usefulness of information shared between value chain members to assess the relative importance of alternative courses of operations (Handfield and Bechtel, 2002). In this study, it refers to the power of information to influence performance outcomes both at individual member- and chain-levels (Zhou and Benton, 2007). More specifically, information quality is characterized by accuracy, relevance and timeliness of information sharing (Zhou and Benton, 2007; Gorla *et al.*, 2010; Fischer, 2013; Popovič *et al.*, 2014). Information is accurate when it is correct and

free from distortions; information is said to be relevant when it is useful and appropriate to support decisions at hand; and information is said to be timely when it is shared on time to keep the receiver in tandem. The study by Daft and Lengel (1986) has noted a positive relationship between information quality and VCI.

Channel use, on the other hand, refers to the type and frequency of media used for information sharing (e.g. face-to-face contact, telephone, fax, electronic data interchange, web-enabled portals such as internet and intranet (Kembro *et al.*, 2014)). The use of traditional channels leads to smooth flow of information between value chain members as compared to the use of advanced channels due to their acceptability, ease of use and cost (Dewett and Jones, 2001).

2.2 VCI

According to Bagchi *et al.* (2005), VCI improves with enhanced management of flows of material, service, financial and knowledge along the value chain. Strong VCI can be achieved through jointly managed flows than through strictly independent management (Wever *et al.*, 2009). In the extreme, VCI might achieve or exceed performance achievable through vertically integration. We propose and use four measures of the extent of VCI: collaboration among chain members by way of resources, capabilities and risk sharing (Childerhouse *et al.*, 2011); commitment toward long-term relationships (Vanpoucke *et al.*, 2009; Awad and Nassar, 2010); and coordination of activities and decisions along the value chain (Malhotra *et al.*, 2005; Wever *et al.*, 2009; Awad and Nassar, 2010) throughout this study.

In this study, collaboration refers to value chain members' readiness to share resources, capabilities and risks (Arshinder and Deshmukh, 2008; Wu *et al.*, 2014). It occurs when costs of large investments are shared among value chain members (Wiengarten *et al.*, 2010). It involves all sorts of cooperation among chain members (Narasimhan and Nair, 2005; Wu *et al.*, 2014). In the views of many researchers, information sharing promotes collaboration between receivers and senders (Lotfi *et al.*, 2013; Wu *et al.*, 2014).

Commitment refers to value chain members' willingness to extend efforts to keep the relationship for long (Morgan and Hunt, 1994; Bastl *et al.*, 2012). In their study, Cechin *et al.* (2013) described three aspects of commitment: affective, normative and continuance. The affective aspect refers to the emotional attachment and desire to remain in relationship; the normative aspect refers to the obligation to stay in relationship; whereas the continuance aspect indicates the lack of choice than to stay in relationship. In the view of Vickery *et al.* (2003), information sharing sustains commitment (Morgan and Hunt, 1994) by way of investing time, money, and facilities in the relationship (Vanpoucke, 2009). According to Wu *et al.* (2014) and Micheels and Gow (2011), commitment enhances value chain members' willingness to share information. This study hypothesized a reverse causal relationship between information sharing and commitment, like it was done in past studies (Arshinder and Deshmukh, 2008; Cao and Zhang, 2010).

In the Oxford dictionary, coordination is defined as a harmonious combination of various activities to achieve better results. It is an act of managing interdependencies of procurement, production and distribution activities (Simatupang *et al.*, 2002; Arshinder and Deshmukh, 2008). The complexities of coordination of activities along value chains can be tackled through sharing sufficient volume and right quality information (Simatupang *et al.*, 2002; Romano, 2003; Arshinder and Deshmukh, 2008). For instance, information on product specification, if shared between members, improves coordination of activities along value chains (Malhotra *et al.*, 2005; Wever *et al.*, 2009).

Joint decision making refers to the level of value chain members' participation on the decisions-making processes of their value chain partners. In the view of Malhotra *et al.* (2005), joint decisions lead to strong VCI since such decisions can easily be implemented. Weaver (2008) presents a microeconomic theory of collaboration based on consideration of joint interests in decisions. Joint decisions are made by joint teams, through participation on decisions of other value chain members, or through effort to indirectly influence decisions of chain partners. Moreover, information sharing along the value chains on decisions made in the past improves commitment during implementation.

In this study, we formulated a framework that envisages the correlations between information sharing constructs (i.e. information volume, information quality and channel used) and VCI. Figure 1 presents our conceptual framework followed in our research hypotheses. Major constructs are shown in bold while specific conceptual items are listed below each construct.

As depicted in the conceptual framework, this study examines whether the generated empirical evidences support the causal-relationships proposed in the following hypotheses:

H1. The volume of information shared along the MBVC positively relates to the extent of VCI.

H2. The quality of information shared along the MBVC positively relates to the extent of VCI.

H3. The extent of channel use to share information along the MBVC positively relates to the extent of VCI.

3. Research methodology

The various concepts described in the framework under Figure 1 are used to measure our conceptual variables. Empirically, we estimate a multiple constructs model to make inferences about the hypothesized causal relations. We employed survey methods to collect data on each indicator. Interview responses were also compiled to complement the survey data.

3.1 Scope and sampling

Our population consists of members of the MBVC in Ethiopia. For field surveys, samples of farmers and traders were drawn from four selected districts of Arsi and West Arsi administrative zones. The districts were selected to achieve wide coverage of

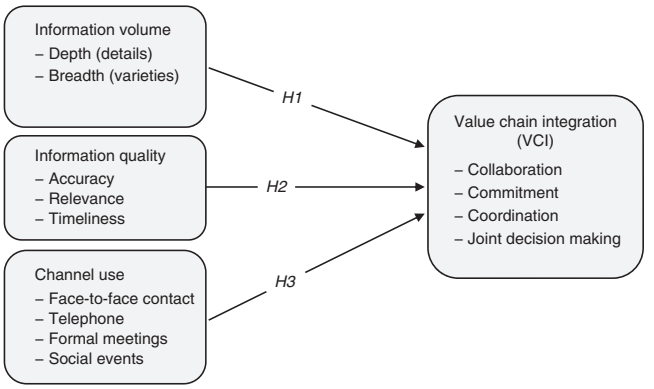

Figure 1.
Rationale for information sharing along the value chains

the malt barley production and marketable surplus (Legesse *et al.*, 2007; Kassahun, 2011) and as per the recommendation of the AMF, the sole malt factory in the MBVC chain and our study area.

A sample of 320 farmers were drawn from Tiyyo and Lemu-Bilbilo districts of Arsi zone and Kofele and Shashmene districts of West Arsi zone, Oromia regional state. Lists of malt barley producers were obtained from district offices of agriculture and used as sample frames to draw 80 farmers from each district through systematic sampling techniques. These sample sizes of farmers drawn from the selected districts constitute from 10 to 15 percent of the total malt barley farmers in the sample frames. Since there are few traders in the study area, we have carried out almost a complete census in which case all a total of 100 willing traders have filled the survey questionnaire.

In addition to the field surveys, qualitative interviews were conducted with 62 respondents of which 27 were farmers, 13 were traders, 17 were cooperatives staff, and five were managers of AMF. Key informants with good understanding about the study concepts were interviewed (Li and Lin, 2006; Vanpoucke, 2009).

3.2 Measurement and scaling

In this study, information volume, information quality and channel use are treated as explanatory variables and VCI as an outcome variable. Respondents were asked to rate the extent of their agreement on questions concerning information volume and information quality. Five-point scales ranging from 1 = strongly disagree to 5 = strongly agree were used to gauge information flow. For the extent of channel use, a five-point scale was used ranging from 1 = very low to 5 = very high (Gorla *et al.*, 2010; Pandey *et al.*, 2010; Fischer, 2013; Popovič *et al.*, 2014). Similarly, respondents were asked to what extent they do agree or disagree with indicators of VCI on the same five-point scales.

3.3 Data collection

Before undertaking full-scale surveys and interviews, separate questionnaires and interview protocols were prepared for each group of MBVC members. A survey questionnaire for farmers was prepared in English and then translated to Afan Oromo, a local language spoken by farmers and then re-translated to English to verify the correctness of translation and to improve clarity. Since traders speak different languages, the English version questionnaires were filled with the help of multilingual enumerators.

The draft questionnaires and protocols were pre-tested with a small set of farmers and traders in April and May, 2013 to ensure content validity. Enumerators were trained on content and ways of administering the survey questionnaires. Following Paulraj *et al.* (2008), the structure, readability, clarity and completeness of questionnaires and protocols were commented by senior researchers in the Agro-food Marketing and Chain Management Division at the Department of Agricultural Economics, Ghent University. Similar to the works of Vanpoucke *et al.* (2009) and Ji *et al.* (2012), the wordings, content, arrangement, and overall structure of these instruments were changed to improve their validity and clarity based on feedbacks obtained from the pilot tests and senior researchers.

The survey data were elicited during June-August, 2013. As mentioned earlier, interviews were conducted alongside field surveys. The principal author had

conducted all interviews using the pre-tested protocols. Each interview was recorded electronically and transcribed verbatim. Respondents were informed in advance about the confidentiality of the answers they provided.

3.4 The study chain

The MBVC provides a rich setting for the study. It is among the most comprehensive agribusiness value chain with several members at various stages. Ethiopia produces about 2.1 million metric tons of barley and top-ranked in the African continent. About 20 percent (i.e. 0.42 million metric tons) are suitable for malting (CSA, 2014). Malt barley makes significant contributions to the national economy (Legesse *et al.*, 2007). Farmers produce malt barley on small plots as a source of income to support their consumption and other expenditures. Farmers' reliance on traditional farming methods has challenged the quantity and quality of malt barley produced. Limited use of improved inputs, limited access to credit, poorly organized cooperatives, and high prices set by private vendors are among the major factors that lower the quantity of quality of malt barley produced. On the other hand, shortage of improved seeds and poor information flow between MBVC members would suggest weak integration along the chain.

After production, malt barley is collected and delivered to the malt factory. Farmers in the study area consume nearly 60 percent of the total malt barley produced at household level for food or feed and retain about 20 percent for seeds for the season that follows. This leaves only 20 percent of production for sale in the value chain. Sales by the households generate cash to satisfy demand for monetized products and services. Malt barley is supplied to AMF most often through traders and partly through cooperatives. A small proportion of supply to AMF follows from direct farm sales either by individual or group of farmers. The AMF produces about 36,000 tons of malt by using 48,000 tons of malt barley per annum. Farmers and traders have voiced strong complaint that the malt factory exercises a monopsony power through which it controls prices of malt barley along the value chain. Traders in the value chain are accused of offering malt barley prices that are below competitive prices. The malt factory releases price information though does so after harvest and after malt barley is sold to traders. This results in farmers not knowing what the market supply is or being able to estimate the market price. In the absence of understanding what prices are being paid and the availability of offers from other traders, they are faced with "take-it or leave it" offers from traders. The timing of farm sales is often driven by uncertainty about future opportunities to sell and urgency of farmers' demands for cash.

Though farmers can make direct sales, the factory often suspends malt barley purchases for several months after harvest. This transfers the right to procure solely to traders, and in the absence of market information available to farmers this may enable traders to procure at prices below what the factory would offer. This provides a margin for procurement services, though may also result in low prices paid to farmers with high demand for cash. Moreover, procurement standards at the malt factory include a minimum transaction of five tons. This forces most farmers to either aggregate their supply offered or sell to traders. However, the substantial heterogeneity of quality of malt barley makes its aggregation difficult. Further, quality control protocol followed by the malt factory requires testing prior to pricing and transaction leaves farmers offering supply with uncertain prices and waiting costs.

The malt factory claims that prices are fairly set based on variety and quality grades. Traders often cite very low inventory turnover ratio due to malt factory's failure to settle credit sales within reasonable time period. Though the malt factory

organizes annual meetings for some chain partners, there exists no open platform or forum for members to regularly meet and discuss on how to improve information sharing and VCI. Though there is suitable agro-ecology for malt barley production in Ethiopia, the chain has failed to meet more 40 percent of malt demands of local breweries and the quality of local malt is also very poor (Kassahun, 2011).

3.5 Data analysis

The analyses presented in this paper are based on both survey data and interview responses. Median values and interquartile ranges (IQR) were used to measure the level of information sharing and the chain's integration given the ordinal nature of our data set (Molnar, 2010). The IQR is the difference between the 75 and 25 percentiles which includes the middle 50 percent of values to ensure that the effects of the outliers are insignificant. Advanced statistics such as factor loadings, Cronbach's α scores, ordered logit regression coefficients, and marginal effects were used for data analysis. Estimation relied on Stata version 12 software package.

Within scale factor loadings and Cronbach's α scores were used to validate multi-item measures (Narasimhan and Nair, 2005; Pandey *et al.*, 2010; Tessema, 2012). Factor loadings were used to ensure construct validity of the set of indicators of the conceptual variables, both explanatory and outcome (Zhou and Benton, 2007). As suggested by Vanpoucke *et al.* (2009), indicators that loaded lower than 0.60 were dropped from further analysis. The summated median values were used for each conceptual variable (Li and Lin, 2006; Pandey *et al.*, 2010). Cronbach's α scores were used to measure the internal consistency of indicators under each variable. All scores are greater than 0.60 to demonstrate sufficient consistency of the indicators (Moberg *et al.*, 2002; Zhou and Benton, 2007; Wu *et al.*, 2014). Since all variables were rated on ordinal scales and the analytical capacity to make fair distinction between orders was very low, the intervals between consecutive orders are unlikely to be equidistant and hence ordered logit regression is appropriate. The cut-off points provided by ordered logit regression are significant and different from 1. Moreover, the degree of skewedness of our dependent variable is as high as negative 0.7 at some of the studied interfaces to show that OLS and probit models are not suitable for the analyses of these data sets.

4. Results and discussions

In this section, we presented the results of both descriptive and regression analyses regarding the status of information sharing and VCI and the relationships between information sharing constructs and VCI.

4.1 Results of descriptive statistics

The descriptive statistics presented in Tables I and II show the volume and quality of information shared between value chain members, the extent of channels use, and the strength of VCI at various MBVC interfaces. According to median values reported in Table I, sufficient volume of information is shared at cooperative-farmer interface than at farmer-trader interface. Similarly, median values for indicators of information quality are slightly higher at cooperative-farmer interface than at farmer-trader interface. This is consistent with key informants' view that quality information is shared at the cooperative-farmer interface.

According to the descriptive statistics and interview responses, neither farmers nor traders use fax, electronic- and snail-mails, and other advanced web-based technologies

Construct	Coop.- farmers interface Median (IQR)	Coop.- farmers interface Factor loading	Farmers-traders interface Median (IQR)	Farmers-traders interface Factor loading
Information volume	($\alpha = 0.806$)		($\alpha = 0.752$)	
We provide varieties of information to chain partners	3.00 (2.00)	0.811	3.00 (2.00)	0.769
We receive varieties of information from chain partners	4.00 (2.00)	0.832	2.00 (1.00)	0.814
We provide detailed information to chain partners	2.00 (1.00)	0.755	2.00 (2.00)	0.792
We receive detailed information from chain partners	2.00 (1.00)	0.806	2.00 (1.00)	0.714
Information quality	($\alpha = 0.892$)		($\alpha = 0.899$)	
We provide timely information to chain partners	3.00 (2.00)	0.780	2.00 (1.00)	0.706
We receive timely information from chain partners	3.00 (2.00)	0.709	2.00 (1.00)	0.795
We provide correct information to chain partners	4.00 (1.00)	0.810	3.00 (2.00)	0.755
We receive correct information from chain partners	3.00 (2.00)	0.786	2.00 (1.00)	0.764
We regularly visit chain partners to get firsthand information	Drop	Drop	2.00 (1.00)	0.737
We are regularly visited by our partners for search of firsthand information	2.00 (2.00)	0.652	3.00 (1.00)	0.709
Information provided to chain partners supports their decisions	3.00 (2.00)	0.750	2.00 (1.00)	0.689
Information received from chain partners supports our decisions	3.00 (2.00)	0.775	2.00 (1.00)	0.793
Channel use	($\alpha = 0.843$)		($\alpha = 0.857$)	
We share information with chain partners face-to-face	3.00 (2.00)	0.811	3.00 (2.00)	0.825
We share information with chain partners through phones	3.00 (2.00)	0.844	3.00 (2.00)	0.798
We share information with chain partners during formal meetings	3.00 (2.00)	0.781	2.00 (2.00)	0.843
We share information with chain partners during social events	3.00 (1.00)	0.864	2.00 (2.00)	0.881
Value chain integration	($\alpha = 0.881$)		($\alpha = 0.760$)	
We and chain partners collaborate as if we are parts of a single firm	3.50 (1.50)	0.857	2.50 (1.00)	0.843
We and chain partners coordinate our activities end-to-end	3.00 (1.00)	0.877	2.00 (1.00)	0.871
We and chain partners are committed toward long-term relationships	3.00 (1.50)	0.874	2.50 (1.00)	0.866
We and chain partners jointly decide on critical operational and strategic issues	2.50 (1.00)	0.841	2.00 (1.00)	0.888

Table I. Median, IQR factor loading and Cronbach's α scores (farmers' survey)

to share information with their chain partners. The median values at farmers' interfaces show that face to face, phone calls, formal and informal meetings are frequently used at cooperative-farmer interface than at farmer-trader interface. This is mainly due to high level of trust to share information at the former interface than the later. Formal and informal meetings are rarely used at the farmer-trader interface though they are used at cooperative-farmer interface. In the opinion of farmers, information on input prices is shared with cooperative staff at social events. Informal meetings are rarely used at farmer-trader interface to share information since traders attend social events seldom, see Table I. The overall assessment of median values of information sharing indicators shows that sufficient volume and better quality information is shared at cooperative-farmer interface than at farmer-trader interface.

During the field survey, farmers were provided with list of information sharing barriers compiled from the literature and asked to identify the ones constraining information sharing in their contexts. Accordingly, 78.4 and 82.5 percent of farmer-

Construct	Farmers-traders interface Mode (IQR)	Factor loading	Traders-AMF interface Median (IQR)	Factor loading
Information volume	($\alpha = 0.769$)		($\alpha = 0.752$)	
We provide varieties of information to chain partners	4.00 (1.00)	0.842	4.00 (1.00)	0.915
We receive varieties of information from chain partners	3.00 (1.00)	0.821	4.00 (1.00)	0.915
We provide detailed information to chain partners	3.00 (1.00)	0.733	Drop	Drop
We receive detailed information from chain partners	Drop	Drop	Drop	Drop
Information quality	($\alpha = 0.909$)		($\alpha = 0.779$)	
We provide timely information to chain partners	4.00 (1.00)	0.827	3.00 (1.00)	0.724
We receive timely information from chain partners	4.00 (2.00)	0.801	3.00 (1.00)	0.623
We provide correct information to chain partners	4.00 (1.00)	0.703	4.00 (1.00)	0.745
We receive correct information from chain partners	3.00 (1.00)	0.730	Drop	Drop
We regularly visit chain partners to obtain firsthand information	3.00 (1.00)	0.595	Drop	Drop
We are regularly visited by our partners for search of firsthand information	3.00 (2.00)	0.743	4.00 (1.00)	0.856
We provide information supporting decisions of chain partners	4.00 (1.00)	0.927	4.00 (1.00)	0.853
Information received from chain partners supports our decisions	4.00 (1.00)	0.738	4.00 (1.00)	0.623
Channel use	($\alpha = 0.671$)		($\alpha = 0.697$)	
We share information with chain partners face-to-face	3.00 (2.00)	0.741	2.00 (1.00)	0.808
We share information with chain partners through phones	2.00 (1.00)	0.826	3.00 (2.00)	0.862
We share information with chain partners during formal meetings	1.00 (1.00)	0.693	2.00 (1.00)	0.718
We share information with chain partners while at social events	2.00 (1.00)	0.615	drop	drop
Value chain integration	($\alpha = 0.881$)		($\alpha = 0.760$)	
We and chain partners collaborate as if we are parts of a single firm	3.00 (1.00)	0.852	2.50 (1.00)	0.847
We and chain partners coordinate our activities end-to-end	2.50 (1.50)	0.831	3.00 (1.50)	0.898
We and chain partners are committed toward long-term relationships	4.00 (1.00)	0.872	2.50 (1.00)	0.855
We and chain partners jointly decide on critical operational and strategic issues	3.00 (2.00)	0.830	2.50 (1.00)	0.851

Table II. Median, IQR factor loading and Cronbach's α scores (traders' survey)

respondents identified inconsistent information system as a barrier to information sharing at cooperative-farmer and farmer-trader interfaces, respectively. Lack of information sharing plans was found to constrain information sharing at cooperative-farmer and farmer-trader interfaces as indicated by 73.0 and 79.7 percent of farmer-respondents, respectively. Lack of trust to share information constrains information sharing at cooperative-farmer and farmer-trader interfaces in the view of 65.1 and 76.5 percent of farmer-respondents, respectively.

The median values reported in Table I for VCI indicators show that farmers disagreement with integration statements at farmer-trader interface than at cooperative-farmer interface.

As it can be seen from Table II, median values at the trader-AMF interface for information volume indicators are high (i.e. 4.00) signaling value chain members' agreement that different types and detailed information is shared. That could be due

to more access to information sharing channels by both members. Face-to-face contact is the most widely used channel at farmer-trader interface, whereas telephone calls are widely used at trader-AMF interface. Formal meetings are the least used channel at traders-malt factory interface. Informal meetings at social event at trader-farmer interface were dropped from the analysis since its factor loading is below the minimum threshold.

The median values for indicators of information sharing variables at farmer-trader interface reveal that sufficient volume and better quality information are shared at this interface though not perceived so by surveyed farmers. We suspected traders' desirability bias for such a result. Otherwise, interviewed farmers pointed out that traders are reluctant to share sufficient volume and better quality information.

Traders were also provided with the same list of barriers to information sharing and asked to identify the ones relevant to their contexts. Accordingly, 93.0 and 91.0 percent of trader-respondents pointed out that lack of training on the importance of information constrains information sharing with farmers and AMF, respectively. Likewise, 83 percent of trader-respondents indicated that the absence of information sharing plans constrains information sharing at traders' interfaces. Inconsistency of information systems was reported to constrain information sharing with farmers and the malt factory as indicated by 73.0 and 79.7 percent of trader-respondents, respectively.

The median values of VCI indicators, except for commitment at farmer-trader interface, are low to indicate traders' disagreement with VCI statements, indicating weak integration at traders' interfaces.

4.2 Results of order logit

As mentioned under data analysis section, we employed the ordered logit regression technique to test our hypotheses at cooperative-farmer, farmer-trader, and trader-AMF interfaces. The types of relationships (i.e. positive, negative, neutral) between information sharing constructs and VCI are investigated. Separate ordered logit regression tables are presented for each interface. Farmers' survey data were used to test hypotheses at farmers' interfaces and traders' survey data were used at traders' interfaces.

The results reported in Table III for the ordered logit regression are based on farmers' survey and show that information volume (*H1*), information quality (*H2*) and channel use (*H3*) are positively correlated with VCI at cooperative-farmer

Table III. Ordered logit regression results at cooperative-farmer interface (farmers' survey)

		Marginal effects on VCI				
VCI	Coef.	1	2	3	4	5
Information volume	0.775**	−0.002	−0.136**	0.046*	0.092**	0.001
Information quality	1.392**	−0.004*	−0.244**	0.082*	0.166**	0.001
Channel use	0.354**	−0.001	−0.062**	0.021*	0.042**	0.000
	Coef.	SE			(95% conf. interval)	
/cut1	1.221	0.608			0.029	2.412
/cut2	5.822	0.566			4.713	6.931
/cut3	8.836	0.714			7.436	10.236
/cut4	14.106	1.265			11.627	16.586

Notes: Ordered logit regression: number of OBS = 320, LR $\chi^2(3) = 204.34$, Prob > $\chi^2 = 0.0000$; log likelihood = −268.76144, pseudo $R^2 = 0.2754$. *,**Significant at $p < 0.05$ and $p < 0.01$

interface. The finding on information quality coincides with the finding of Wiengarten *et al.* (2010) where positive association was noted between information quality and VCI. The marginal effects reported in Table III show that an improvement of the ratings of information quality indicators by one unit, say, from "neutral" to "agree" would increase the chance that the ratings of VCI indicators would make the same change by 16.60 percentage.

At farmer-trader interface, information volume (*H1*), information quality (*H2*) and channel use (*H3*) are positively related to VCI based on farmers' survey. Information quality appears to strongly influence VCI, see the marginal effects reported in Table IV. For example, when the ratings of information quality indicators improve by one unit, say, from "disagree" to "neutral," the chance that the ratings of VCI indicators make the same leap would increase by 33.5 percentage. This shows the importance of information quality to strengthen VCI. Likewise, the same change in the ratings of channel use indicators would increase the chance that ratings of VCI indicators makes the same jump by 10.5 percentage.

At trader-farmer interface, information volume (*H1*) is found to have no significant positive influence on VCI based on traders' survey. Whereas a positive relationship was noted between information quality (*H2*) and VCI at the same interface. The same case was reported by Daft and Lengel (1986) that information quality positively relates to VCI. When the ratings of information quality indicators improve by one unit from "neutral" to "agree," the chance that the ratings of VCI indicators would make the same jump increases by 18.2 percentage (see Table V). Channel use was not

Table IV. Ordered logit regression results at farmer-trader interface (farmers' survey)

		Marginal effects on VCI				
VCI	Coef.	1	2	3	4	5
Information volume	1.064**	−0.017**	−0.233**	0.235**	0.016**	0.000
Information quality	1.521**	−0.024**	−0.333**	0.335**	0.022**	0.000
Channel use	0.477**	−0.008*	−0.105**	0.105**	0.007**	0.000
	Coef.	SE			(95% Conf. interval)	
/cut1	3.440	0.491			2.477	4.403
/cut2	8.054	0.677			6.727	9.381
/cut3	11.749	0.875			10.033	13.464

Notes: Ordered regression: number of OBS = 320, LR $\chi^2(3) = 240.83$, Prob > $\chi^2 = 0.0000$; log likelihood = −236.79731: pseudo $R^2 = 0.3371$. *,**Significant at $p < 0.05$ and $p < 0.01$

Table V. Ordered logit regression results at farmer-trader interface (traders' survey)

		Marginal effects on VCI				
VCI	Coef.	1	2	3	4	5
Information volume	0.443	0.000	−0.053	−0.018	0.074	0.000
Information quality	1.080**	0.000	−0.129**	−0.045	0.182**	0.000
Channel use	0.033	0.000	−0.004	−0.001	0.006	0.000
	Coef.	SE			(95% conf. interval)	
/cut1	3.246	1.052			1.184	5.307
/cut2	3.327	1.054			1.262	5.393
/cut3	6.369	1.242			3.935	8.803

Notes: Ordered logit regression: number of OBS = 100.00, LR $\chi^2(3) = 25.71$, Prob > $\chi^2 = 0.0000$; log likelihood = −91.240457: pseudo $R^2 = 0.1235$. *,**Significant at $p < 0.05$ and $p < 0.01$

found to have a significant positive influence on VCI at farmer-trader interface based on traders' survey.

Information volume (*H1*) was found to have a significant positive influence on VCI at traders-AMF interface (see Table VI). When the ratings of information volume indicators increase by one unit, for instance, from "disagree" to "neutral," the chance that the rating of VCI indicators make the same change increases by 28.1 percentage. Information quality and channel use were not found to have a significant positive relationship with VCI at the same interface. In the views of interviewed malt factory managers, the factory has very low trust in traders for their ruin malt barley quality through adulteration for opportunism. Narasimhan and Nair (2005) state similar case where lack of trust to share information with other value chain members weakens VCI.

5. Conclusions and managerial implication

This study has investigated how information volume, information quality and channel use are related to VCI at most studied MBVC interfaces. The analysis provide empirical evidences on critical metrics of information sharing such as information volume, information quality and channel use which were ignored in previous literature, especially in the context of complex agribusiness value chains. The analyses presented in this study suggest that inconsistent information systems, lack of awareness regarding the importance of information sharing to strengthen VCI, absence of information sharing plans and low level of trust to share information are common barriers to information sharing in the studied value chain.

The multidimensional metrics of information sharing offer value chain members useful managerial insights on information sharing variables and their relationship with VCI. Those identified barriers to information sharing help value chain members and their collaborators to take appropriate actions to improve the strength of VCI. For instance, farmers and their chain partners could benefit if they harmonize their information sharing systems. They should agree on how to share product and/or service specifications, demand and delivery schedules of both agricultural inputs and malt barley at the right time through effective communication channels use. Since farmers prefer to share information during informal social gathering, their value chain partners, especially traders should better utilize this channel to expedite information sharing with the farmers. The lack of electricity supply in rural villages to charge phone batteries and the high charge for mobile use constrained farmers to use their mobile phones to share information with their chain partners. This problem can easily

Table VI.
Ordered logit regression results at traders-AMF interface (traders' survey)

		Marginal effects on VCI				
VCI	Coef.	1	2	3	4	5
Information volume	1.188**	−0.0134	−0.283**	0.281**	0.016	0.000
Information quality	−0.123	0.001	0.029	−0.029	−0.002	0.000
Channel use	0.260	−0.003	−0.062	0.061	0.003	0.000
	Coef.	SE			(95% conf. interval)	
/cut1	−0.102	1.243			−2.538	2.334
/cut2	4.286	1.224			1.887	6.684
/cut3	8.649	1.513			5.683	11.614

Notes: Ordered logit regression: number of OBS = 100, LR $\chi^2(3) = 20.21$, Prob > $\chi^2 = 0.0000$; log likelihood = −75.780432; pseudo $R^2 = 0.1180$. *,**Significant at $p < 0.05$ and at $p < 0.01$

be tackled if alternative means to charge phone batteries and top-ups to support calls from mobile phones are provided to the farmers by their chain partners and/or other collaborators.

Information sharing between traders and other chain partners is highly constrained by lack of trust caused by the opportunistic behavior of traders. Traders usually block price information and quality specifications provided by the malt factory from reaching the farmers to influence the negotiation power of farmers. Farmers and the malt factory are also hesitant to share information with traders out of suspicion that traders use it to serve their opportunistic desires. As long as traders are the key players in the aggregation and supply of malt barley to the malt factory, their integration to the chain through free flow of information between them and other value chain members needs to be given special attention. Alternatively, the malt factory and its collaborators should encourage the free flow of information with farmers and cooperatives with an ultimate goal of convincing farmers to supply directly to the malt factory or through cooperatives.

This study also revealed that information sharing is a multi-faceted concept with information volume, information quality and channels usage as its key concepts that have significant positive influences on VCI. The MBVC members and policymakers should work toward the inclusion of these concepts in information sharing plans of individual-members and the entire agribusiness value chain. Value chain members should also be given trainings on concepts of information sharing and their importance to promote value chain knowledge, thinking and integration to enhance performance.

The flow of sufficient volume and better quality information along effective and efficient channels would strengthen VCI which is manifested through improved collaboration among members, enhanced commitment toward long-term relationships, and tightened coordination of activities and decisions along the chain. The enhancement of MBVC integration through effective information sharing along the chain promotes inclusive growth of all chain members including small-scale farmers which in turn ensures sufficient and sustainable supply of quality malt barley from local sources.

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References

Arshinder, A. and Deshmukh, G. (2008), "Supply chain coordination: perspectives, empirical studies and research directions", *International Journal of Production Economics*, Vol. 115 No. 2, pp. 316-335.

Awad, H. and Nassar, M. (2010), "Supply chain integration: definition and challenges", paper presented at the International Multi-Conference of Engineers and Computer Scientists, Hong Kong, March 17-19.

Bagchi, P., Ha, B., Skjoett-Larsen, T. and Soerensen, L. (2005), "Supply chain integration: a European survey", *International Journal of Logistics Management*, Vol. 16 No. 2, pp. 275-294.

Bagchi, P.K. and Skjoett-Larsen, T. (2003), "Integration of information technology and organizations in a supply chain", *The International Journal of Logistics Management*, Vol. 14 No. 1, pp. 89-108.

Bastl, M., Johnson, M., Lightfoot, H. and Evans, S. (2012), "Buyer-supplier relationships in a servitized environment: an examination with cannon and Perreault's framework", *International Journal of Operations & Production Management*, Vol. 32 No. 6, pp. 650-675.

Cao, M. and Zhang, Q. (2010), "Supply chain collaborative advantage: a firm's perspective", *International Journal of Production Economics*, Vol. 128 No. 1, pp. 358-367.

Cechin, A., Bijman, J., Pascucci, S. and Omta, O. (2013), "Decomposing the member relationship in agricultural cooperatives: implications for commitment", *Agribusiness*, Vol. 29 No. 1, pp. 39-61.

Childerhouse, P., Deakins, E., Bohme, T., Towill, D., Disney, S. and Banomyong, R. (2011), "Supply chain integration: an international comparison of maturity", *Asian Pacific Journal of Marketing and Logistics*, Vol. 23 No. 4, pp. 531-552.

CSA (2014), "Report on area and production of major crops", The Federal Democratic Republic of Ethiopia: Central Statistics Agency. I, Addis Ababa.

Daft, R.L. and Lengel, R.H. (1986), "Organizational information requirements, media richness and structural design", *Management Science*, Vol. 32 No. 5, pp. 554-571.

Dewett, T. and Jones, G.R. (2001), "The role of information technology in the organization: a review, model, and assessment", *Journal of Management*, Vol. 27 No. 3, pp. 313-346.

Fischer, C. (2013), "Trust and communication in European agri-food chains", *Supply Chain Management: An International Journal*, Vol. 18 No. 2, pp. 208-218.

Giunipero, L.C., Hooker, R.E., Joseph-Matthews, S., Yoon, T.E. and Brudvig, S. (2008), "A decade of SCM literature: past, present and future implications", *Journal of Supply Chain Management*, Vol. 44 No. 4, pp. 66-86.

Gorla, N., Somers, T.M. and Wong, B. (2010), "Organizational impact of system quality, information quality, and service quality", *The Journal of Strategic Information Systems*, Vol. 19 No. 3, pp. 207-228.

Handfield, R.B. and Bechtel, C. (2002), "The role of trust and relationship structure in improving supply chain responsiveness", *Industrial Marketing Management*, Vol. 31 No. 4, pp. 367-382.

Hartono, E., Li, X., Na, K.-S. and Simpson, J.T. (2010), "The role of the quality of shared information in interorganizational systems use", *International Journal of Information Management*, Vol. 30 No. 5, pp. 399-407.

Holweg, M., Disney, S., Holmström, J. and Småros, J. (2005), "Supply chain collaboration: making sense of the strategy continuum", *European Management Journal*, Vol. 23 No. 2, pp. 170-181.

Ji, C., Felipe, I., Briz, J. and Trienekens, J. (2012), "An emperical study on govenance structure choices in China's pork supply chain", *International Food and Agribusiness Management Review*, Vol. 15 No. 2, pp. 121-152.

Kassahun, T. (2011), "Malting barley marketing and malt production from barley in Ethiopia", paper presented at the Barley Research and Development in Ethiopia, Holeta Agricultural Research Centre, Ethiopia, November 28-30, 2006.

Kembro, J., Selviaridis, K. and Näslund, D. (2014), "Theoretical perspectives on information sharing in supply chains: a systematic literature review and conceptual framework", *Supply Chain Management: An International Journal*, Vol. 19 Nos 5/6, pp. 609-625.

Ketzenberg, M. (2009), "The value of information in a capacitated closed loop supply chain", *European Journal of Operational Research*, Vol. 198 No. 2, pp. 491-503.

Kulp, S.C., Lee, H.L. and Ofek, E. (2004), "Manufacturer benefits from information integration with retail customers", *Management Science*, pp. 431-444.

Lazzarini, S.G., Chaddad, F.R. and Cook, M.L. (2001), "Integrating supply chain and network analyses: the study of netchains", *Journal on Chain and Network Science*, Vol. 1 No. 1, pp. 7-22.

Legesse, G., Debebe, S. and Alemu, T. (2007), "Assessing the uncomparative advantage of malt barley production in Ethiopia: application of policy analysis matrix", paper presented at the 8th African Crop Science Society Conference El-Minia, October 27-31.

Li, S. and Lin, B. (2006), "Accessing information sharing and information quality in supply chain management", *Decision Support Systems*, Vol. 42 No. 3, pp. 1641-1656.

Lotfi, Z., Mukhtar, M., Sahran, S. and Zadeh, A.T. (2013), "Information sharing in supply chain management", *Procedia Technology*, Vol. 11, pp. 298-304, available at: www.sciencedirect.com/science/article/pii/S2212017313003484

Malhotra, A., Gosain, S. and Sawy, O.A.E. (2005), "Absorptive capacity configurations in supply chains: gearing for partner-enabled market knowledge creation", *MIS Quarterly*, pp. 145-187.

Micheels, E.T. and Gow, H.R. (2011), "The moderating effects of trust and commitment on market orientation, value discipline clarity, and firm performance", *Agribusiness*, Vol. 27 No. 3, pp. 360-378.

Moberg, C.R., Cutler, B.D., Gross, A. and Speh, T.W. (2002), "Identifying antecedents of information exchange within supply chains", *International Journal of Physical Distribution & Logistics Management*, Vol. 32 No. 9, pp. 755-770.

Molnar, A. (2010), "Supply chain performance and relationships: the European traditional food sector", PhD, Ghent University, Ghent.

Morgan, R.M. and Hunt, D.S. (1994), "Commitment-trust theory of relationship marketing", *Journal of Marketing*, Vol. 58 No. 3, pp. 20-38.

Munyua, H.M. and Stilwell, C. (2013), "Three ways of knowing: agricultural knowledge systems of small-scale farmers in Africa with reference to Kenya", *Library & Information Science Research*, Vol. 35 No. 4, pp. 326-337.

Narasimhan, R. and Nair, A. (2005), "The antecedent role of quality, information sharing and supply chain proximity on strategic alliance formation and performance", *International Journal of Production Economics*, Vol. 96 No. 3, pp. 301-313.

Pandey, V.C., Garg, S.K. and Shankar, R. (2010), "Impact of information sharing on competitive strength of Indian manufacturing enterprises: an empirical study", *Business Process Management Journal*, Vol. 16 No. 2, pp. 226-243.

Paulraj, A., Lado, A.A. and Chen, I.J. (2008), "Inter-organizational communication as a relational competency: antecedents and performance outcomes in collaborative buyer-supplier relationships", *Journal of Operations Management*, Vol. 26 No. 1, pp. 45-64.

Popovič, A., Hackney, R., Coelho, P.S. and Jaklič, J. (2014), "How information-sharing values influence the use of information systems: an investigation in the business intelligence systems context", *Journal of Strategic Information Systems*, Vol. 23 No. 4, pp. 270-283.

Romano, P. (2003), "Co-ordination and integration mechanisms to manage logistics processes across supply networks", *Journal of Purchasing and Supply Management*, Vol. 9 No. 3, pp. 119-134.

Sahin, F. and Robinson, E.P. (2002), "Flow coordination and information sharing in supply chains: review, implications, and directions for future research", *Decision Sciences*, Vol. 33 No. 4, pp. 505-536.

Simatupang, T., Wright, A. and Sridharan, R. (2002), "The knowledge of coordination for supply chain integration", *Business Process Management Journal*, Vol. 8 No. 3, pp. 289-308.

Tessema, W.K. (2012), "Marketing's contribution to the sustainability of pastoralism: evidence from Ethiopia", PhD, Wageningen University, Wageningen.

Vanpoucke, E. (2009), "Supply chain integration and performance: empirical essays in a manufacturing context", PhD, Ghent University, Ghent.

Vanpoucke, E., Boyer, K.K. and Vereecke, A. (2009), "Supply chain information flow strategies: an empirical taxonomy", *International Journal of Operations & Production Management*, Vol. 29 No. 12, pp. 1213-1241.

Vickery, S.K., Jayaram, J., Droge, C. and Calantone, R. (2003), "The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships", *Journal of Operations Management*, Vol. 21 No. 5, pp. 523-539.

Weaver, R.D. (2008), "Collective pull innovation: origins and adoption in the new economy", *Agribusiness*, Vol. 24 No. 3, pp. 388-402.

Weaver, R.D. (2010), "Supply chain and network performance: metrics for profitability, productivity and efficiency", *International Journal on Food System Dynamics*, Vol. 1 No. 1, pp. 56-68.

Wever, M., Wognum, N. and Trienekens, J. (2009), "Supply chain integration and coordination in the agri-food sector", *15th International Conference on Concurrent Enterprising*, pp. 22-24.

Wiengarten, F., Humphreys, P., Cao, G., Fynes, B. and McKittrick, A. (2010), "Collaborative supply chain practices and performance: exploring the key role of information quality", *Supply Chain Management: An International Journal*, Vol. 15 No. 6, pp. 463-473.

Wu, I.-L., Chuang, C.-H. and Hsu, C.-H. (2014), "Information sharing and collaborative behaviours in enabling supply chain performance: a social exchange perspective", *International Journal of Production Economics*, Vol. 148, pp. 122-132, available at: www.sciencedirect.com/science/article/pii/S0925527313004210

Zhou, H. and Benton, W.C. Jr (2007), "Supply chain practice and information sharing", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1348-1365.

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