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The influence of value chain integration on performance: an empirical study of the malt barley value chain in Ethiopia

RESEARCH ARTICLE

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Abstract

The purpose of this study is to examine the interplay between value chain integration dimensions and value chain performance along the malt barley value chain in Ethiopia. The analyses were based on survey data sets obtained from 320 farmers and 100 traders and qualitative interview responses captured from sixty-two key informants selected from members of the chain. The structural equation modelling technique was employed to seek answer for the question of how value chain integration dimensions are related to performance. The results of the analyses showed the existence of positive relationships between coordination of activities and performance; between joint decision-making and performance at farmers-cooperatives interface; and between commitment towards long-term relationships and performance at farmers-traders interface. The study has made important empirical contributions in areas of value chain integration and performance and their interplays within the context of the studied malt barley value chain. The key findings of the study make important policy implications for agribusiness value chains in the developing countries. The study would open a venue for robust investigation based on a wider database from various agribusiness chains in Ethiopia or even beyond, for better validation of the findings.

Keywords: value chain integration, value chain performance, malt barley value chain, Ethiopia
JEL code: Q13

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1. Introduction

Value chain is a set of three or more members, either organizations or individuals or both. They take part in the forward and reverse flows of materials, services, finances and information from their sources to destinations to create values in the form of products and/or services for customers (Bagchi *et al.*, 2005). In the view of same authors, value chain integration (VCI) deals with the management of these flows to provide superior values to end users (Bagchi *et al.*, 2005). In simple terms, VCI is defined as a set of relationships among suppliers, processors, distributors, retailers and consumers that facilitate the conversion of raw materials into products or services of more value (Darroch and Mushayanyama, 2006; Wever *et al.*, 2009). VCI is a means to create a match between demand and supply of products and/or services at every stage along the value chain (Barratt, 2004). In this study, VCI is defined with the help of four latent concepts termed as 'VCI dimensions' throughout the paper. These are: (1) collaboration among value chain members in terms of resources, capabilities and risks sharing; (2) commitment towards long-term relationships; (3) coordination of activities along the value chain; and (4) joint decision-making on key issues like product specification and prices and process improvements. Since past studies focused on VCI as a single variable (Lotfi *et al.*, 2013b), this study is relevant for its completeness.

Many past studies generally claimed that VCI improves value chain performance (VCP) outcomes (Arshinder and Deshmukh, 2008; Kim, 2009;Vickery *et al.*, 2003; Wever *et al.*, 2009; Zhao *et al.*, 2008) commonly measured in terms product quality, responsiveness, flexibility and efficiency (Wu *et al.*, 2014). However, the results of these studies are inconsistent (Wiengarten *et al.*, 2010). Moreover, there is a dearth of literature to empirically verify the association between VCI dimensions and VCP (Vereecke and Muylle, 2005; Sezen, 2008; Vanpoucke, 2009; Vickery *et al.*, 2003), especially empirical data from developing countries are scanty (Chin *et al.*, 2014). In the view of Lotfi *et al.* (2013b) past studies dealt with dyadic interactions between a single value chain member and its chain partners; while chain-level studies were not only few but also descriptive. On the other hand, Bagchi *et al.* (2005) noted variations in the types of associations between VCI dimensions and VCP whereby commitment showed negative association with VCP while collaboration is positively associated. Moreover, the types of relationships exhibited between VCI dimensions and VCP under one context may not be equally valid under another (Hausman, 2001) and VCI may not always guarantee higher VCP (Vanpoucke, 2009). Therefore, the purpose of this study is to shade light on this research gaps with the help of empirical data obtained from the malt barley value chain (MBVC) in Ethiopia.

More specifically, the study aims to: (1) conceptualize the multidimensional constructs of VCI and VCP; (2) measure the current levels of MBVC integration and performance; (3) investigate the relationship between VCI dimensions and VCP at chain-level; and (4) provide some policy implications to address VCI and VCP related challenges in the MBVC in particular and in the agribusiness value chains of developing countries in general.

The MBVC is a suitable source of empirical data for this study given the big paradox of chain's failure to meet more than 40% of the demands for malt from local breweries, though the country produces the largest volume of barley in the African continent. The chain is characterized by limited participation of cooperatives, marginalization of upstream members, involvement of highly opportunistic traders, and dominance of single malt factory both as a buyer of malt barley and seller of malt. The malt factory expresses bitter complaints about the supply of inferior quality malt barley from local sources. The country spends huge amount of foreign currency on imported malt. This study, therefore, seeks an answer as to how VCI dimensions influence VCP outcomes within the context of the MBVC in Ethiopia.

The remaining parts of the paper are structured as follows. In the next section, we provide theoretical underpinning of the conceptual framework to set the bases for our research hypotheses. Subsequently, the research methodology is explained, followed by results and discussions. Finally, conclusions are drawn and practical implications are indicated.

2. Conceptual framework and research hypotheses

A conceptual framework for this study was adapted from past study to postulate possible associations between VCI dimensions and VCP which were tested using empirical data obtained from the MBVC in Ethiopia. The framework is primarily based on the resource based view (RBV) which creates a conducive environment to pool resources and capabilities through VCI for superior VCP outcomes (Chin *et al.*, 2014). In the view of Barratt (2004), VCI can only be materialized when members collaborate through resources, capabilities and risks sharing. Similarly, Kim (2009) stressed on the concepts of RBV as key enablers of VCI. According to RBV, resources refer to both tangible and intangible assets, whereas capabilities refer to members' ability to utilize these resources to achieve higher performance outcomes. No matter how diverse and huge the resources owned by a single member are, it is still not feasible for this member to own every kinds of resources and capabilities in-house. Therefore, VCI is a strategic tool with which members may acquire inimitable complementarities of resources, capabilities and risks that lead to superior VCP.

As indicated earlier, VCI is conceptualized in terms of four key dimensions. These are: collaboration (Lotfi *et al.*, 2013b; Wu *et al.*, 2014), commitment (Cechin *et al.*, 2013), coordination (Van Donk *et al.*, 2008), and joint decisions making (Malhotra *et al.*, 2005) to capture its broader and important aspects. As indicated earlier, the other core construct in this study is VCP. In the view of Chan *et al.* (2003), VCP can be measured using both qualitative and quantitative indicators. In the view of Lotfi *et al.* (2013a), measurement indicators like added values, efficiency, and customers' satisfaction can be used to measure VCP. The study by Simatupang and Sridharan (2001) suggests the use of process efficiency, customer satisfaction and financial indicators. In their study on the relationship between VCP and members' linkages, Won Lee *et al.* (2007) measured performance using efficiency and effectiveness as indicators. Though various performance measurement indicators were proposed, they are all highly interrelated (Vickery *et al.*, 2003).

In most cases, financial indicators are used to measure VCP, though they are not inclusive of all aspects of performance and they are also exposed for misinterpretations (Wu *et al.*, 2014). In immature value chains like the MBVC, data on financial indicators are either unavailable or inaccessible even if available. In line with past studies and data availability, four key indicators were identified to measure MBVC performance. These are: quality, responsiveness, flexibility and efficiency (Gellynck *et al.*, 2008; Vickery *et al.*, 2003; Wu *et al.*, 2014; Zhao *et al.*, 2008). These indicators are broadly acceptable as complete and inclusive (Vereecke and Muylle, 2005). In line with the study by Schloetzer (2012), MBVC members' perceptions on these indicators were used in this study:

- *Quality* refers to a fitness of products and services to the needs of customers (Lotfi *et al.*, 2013b). In the view of Cao and Zhang (2010), quality refers to the extent to which value chain members offer reliable products that can create greater value for customers. In this paper, quality refers to the moisture content, mix level with other barley varieties, and neatness of the malt barley grains. According to the quality standard set by the malt factory, malt barley grains with low moisture level, admixture free, neat and white are ranked high on the quality scale. These measures of quality are equivalent to 'attractiveness' in the view of Molnar (2010) which explains how appealing the appearance of product is to the eyes of customers.
- *Responsiveness* is the measure of capability of value chain members to provide the right product or appropriate service or both within the shortest possible time after receiving orders from the customers (Molnar, 2010). According to her study, lead-time and customers complaints are key indicators of responsiveness.
- *Flexibility* refers to value chain members' capacity and capability to support changes in products and service specifications to meet the changing needs of customers (Cao and Zhang, 2010). In the view of Sezen (2008), product flexibility, delivery flexibility, mix flexibility and volume flexibility are important aspects of flexibility.
- *Efficiency* refers to the wise use of available resources to generate the maximum possible return while achieving cost competitiveness (Cao and Zhang, 2010). It is a comparison between costs incurred

and benefits gained in connection with value adding undertakings. It deals with process optimization to produce outputs of higher value using inputs of less value.

Based on the literature, the conceptual framework presented under Figure 1 was developed to guide hypotheses formulation, research design, and data analysis and discussion. In the framework, the main constructs are presented in bold and the conceptual indicators are placed in smaller boxes.

Collaboration

Collaboration among value chain members is identified as VCI dimension and is understood as a win-win philosophy whereby resources, capabilities, and risks are shared among value chain members to achieve higher VCP (Vereecke and Muylle, 2005). In the views of Vieira *et al.* (2009) and Arshinder and Deshmukh (2008), collaboration is a trustful, loyal and mutual interactions between value chain members and joint efforts towards improved VCP. Collaboration materializes only when value chain members cooperate (Cao and Zhang, 2010).

Collaboration is conceptualized to express the extent to which resources (Cao and Zhang, 2010; Wiengarten *et al.*, 2010) and capabilities (Vieira *et al.*, 2009) are shared along the value chain for the purpose of complementarity. In the view of Stank *et al.* (2001), collaboration is a low-cost strategy that reduces operational wastes and redundancies to improve product and service quality. Whereas, Wiengarten *et al.* (2010) reported inconsistencies among findings of past studies that relate collaboration and VCP. In their study, Vereecke and Muylle (2005) call for additional empirical underpinning to substantiate the positive interplay between collaboration and performance. Based on the above premises, the following hypothesis was proposed.

H_1: collaboration between value chain members positively relates to VCP.

Commitment

Commitment is defined as an enduring desire to maintain long-term relationship between value chain members (Hausman, 2001). Value chain members are committed to long-term relationship when they believe in its importance to enable them achieve higher performance (Darroch and Mushayanyama, 2006; Morgan and Hunt, 1994; Zhao *et al.*, 2008). In the view of Brown *et al.* (1996), commitment can be classified as normative and instrumental. Normative commitment is a mutual and ongoing relationship over an extended time period based on high trust level between value chain members. Whereas, instrumental commitment refers to value chain members' readiness to bear influences imposed by other value chain members, its ultimate goal being either receipt of rewards or avoidance of punishments. In the view of Wu *et al.* (2004), commitment is a multifaceted construct of three key aspects: affective, continuance and normative commitments. The affective aspect refers to value chain members' sense of belongingness and attachment to the value chain; the continuance aspect refers to the perceived high costs if value chain members exit from the value chain; and the normative aspect explains both implicit and explicit obligations on value chain members to stay in the value chain.

Past studies asserted that commitment towards long-term relationships positively relates to VCP (Brown *et al.*, 1996). In the view of Hausman (2001), less committed value chain members make less effort and resource contributions to ensure higher performance. Similarly, Clarke (2006) suggests that commitment to long-term relationships is a chief strategic tool to improve VCP. Based on these premises, the following relationship was proposed.

H_2: commitment towards long-term relationships positively relates to VCP.

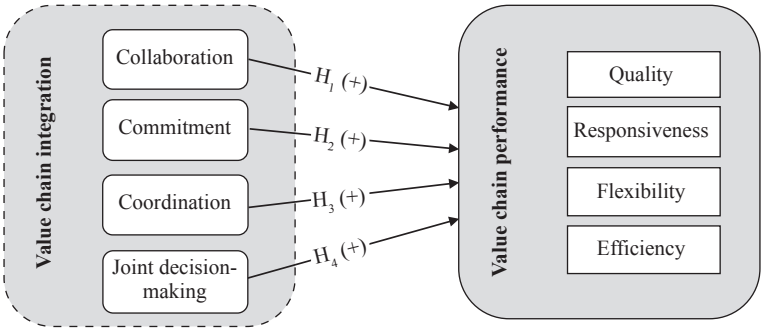

Figure 1. Hypothetical conceptual framework. H_1 to H_4 = hypotheses 1 to 4 (adapted from Vickery *et al.*, 2003).

Coordination

As noted by Arshinder and Deshmukh (2008), coordination of activities along the value chain requires clear definition of all activities and their proper alignment with value chain goals. It is the act of managing interdependences of the procurement, production and distribution activities along the value chain to improve VCP (Arshinder and Deshmukh, 2008; Vickery *et al.*, 2003). In the view of Darroch and Mushayanyama (2006), coordination of activities along the value chain lowers transaction costs and raises VCP. Furthermore, coordination of activities along the value chain improves members' responsiveness by shortening lead times and increasing members' flexibility through capacity building. Based on these premises, the following hypothesis was forwarded.

H_3: coordination of activities along the value chain positively relates to VCP.

Joint decision-making

Joint decision-making refers to the level of participation of value chain members in the decision-making processes of chain partners or the level of sharing decision support information or both (Malhotra *et al.*, 2005; Wiengarten *et al.*, 2010). In the view of Wiengarten *et al.* (2010), joint decision-making positively relates to operational performance in chain settings, but only if substantiated with free flow of sufficient and quality information along the value chain. Though some authors conceptualize joint decision-making as part of collaboration, members of the malt MBVC consider it as an essential dimension of VCI that should be separately treated. Based on the above premises, the following hypothesis was forwarded.

H_4: joint decision-making on critical issues like product specifications and prices positively relates to CVP.

3. Research methodology

The study contexts and data sources

In order to test the validity of proposed associations between conceptual constructs, survey data and interview responses were collected from sample respondents and key informants drawn from MBVC members in Ethiopia. The MBVC is one of the most comprehensive agribusiness value chains in Ethiopia in which several members participate at various stages. The key members of the chain are small-scale farmers, traders, cooperatives, the malt factory, and breweries performing various value adding activities to produce malt barley and ultimately convert it to beer. According to the malt factory, half a million small-scale farmers produce an aggregate of 2.1 million metric tons of barley, which makes Ethiopia the first in the African continent in terms of production volume of which 20% (i.e. 420 thousand metric tons) is suitable for malting. Hence, malt barley makes significant contributions to the national economy (Legesse *et al.*, 2007). Both survey

data and interview responses needed for this study were obtained from selected small-scale farmers, traders, cooperatives staff, and malt factory managers.

Small-scale farmers, one of our data sources, are price takers. Due to subsistence nature and risk aversive behavior, these farmers produce malt barley along with other crops for diversification purpose. Since malt barley is also suitable for food and feed, farmers consume nearly 60% of malt barley in-house and sell only about 20% to meet cash needs after reserving some portion for seeds (Legesse *et al.*, 2005). These farmers sell malt barley mostly to traders and rarely to cooperatives at very low prices. Few farmers make direct sales to the malt factory either individually or in groups, because the minimum procurement lot of 5 tons per transaction set by the malt factory discourages the farmers to use this option.

Even though hundreds of traders participate in malt-barley collection, only about thirty large ones supply nearly 90% of malt factory's needs. The large traders collect malt barley from farmers, small traders, and commission agents. Most traders, both large and small, have very good experience to easily identify good quality malt barley from bad ones. If the malt factory pays premium prices, traders can supply best quality malt barley to the factory. Unfortunately, traders opt to mix high quality malt barley with malt barley of low quality to claim good prices since premium prices paid by the factory for best quality is not as such attractive.

Cooperatives, another data source of this study, rarely participate in malt barley collections though the malt factory always encourages them to engage on this business. Except one cooperative union in Lemu-bilbilo and another one in Kofele districts, cooperatives in the study area are not engaged in malt barley collection due to structural rigidity, capital limitation, unfair competition from traders, farmers' reluctance to sell to them, and over-stretching situations regarding the supply of agricultural inputs.

The other data source for this study is the malt factory. It is the single dominant buyer of malt barley from farmers, traders and cooperatives (a monopsony) and the single dominant local seller of malt to local breweries (monopoly). The factory can produce 36,000 metric tons of malt per annum out of 50,000 tons of malt barley if operates at full capacity. Presently, the factory's capacity utilization rate hovers around 80% mainly due to shortage of supply of malt barley with the required quality standards. Its dominance both in the malt barley market as a buyer and malt market as a seller makes it a single price maker in the chain.

Sampling and data collection

In line with past studies, both qualitative and quantitative data were collected through field surveys and qualitative interviews with selected farmers, traders, cooperatives staff, and malt factory managers. Farmers, traders and cooperatives were selected from Lemu-bilbilo and Tiyyo districts of Arsi zone and from Kofele and Shashemene districts of West Arsi zone. These districts were purposively selected for their wider coverage of malt barley production and market surplus based on the information obtained from the malt factory. From each selected district, random samples of 80 farmers were systematically drawn whereby the k^{th} farmers in the intervals were selected for inclusion in the samples, the starting point being randomly selected from the first interval. The lists of farmers, which are our sampling frames, were obtained from district offices of agriculture. A total of 100 traders, 25 from each selected districts, were included in the survey. Farmers' and traders' surveys were conducted during June to August 2013.

Prior to data collection, structured questionnaires and interview guides were prepared. The English version of farmers questionnaire was translated into Afan Oromo, the language spoken in the study area, and then re-translated to English to verify the correctness of the translation and to improve clarity. Since traders speak different languages, experienced and multilingual enumerators were hired to translate the English version questionnaire to languages of traders while conducting the surveys (Vanpoucke, 2009). The survey questionnaires and interview guides were pilot tested with few farmers and traders in months of April and May 2013 to ensure content validity. The structure, readability, clarity and completeness of the questionnaires and guides were also reviewed by senior researchers in Agro-food marketing and chain management division

of the Department of Agricultural Economics at Ghent University, Belgium to further improve the validity and clarity of these instruments based on feedbacks from the pilot tests and comments from the researchers.

Intensive literature review was done to identify suitable indicators for VCI dimensions and VCP and formulated into various statements to develop the survey questionnaires and interview guides. Survey respondents (i.e. farmers, traders, cooperatives staff, and malt factory managers) were asked to rate the extent of their agreements or disagreement on the statements under VCI dimensions and VCP on five-point scales, 1 = 'strongly disagree' and 5 = 'strongly agree'.

In addition to the field surveys, 62 qualitative interviews were conducted of which 27 were with farmers, 13 with traders, 17 with cooperatives staff, and 5 with malt factory managers. Farmers and traders were interviewed to triangulate the survey data sets. Surveys were not conducted with cooperatives staff and the malt factory managers due to small sample size. For all qualitative interviews, MBVC members with good know-how on the operation of the value chain were purposively selected (Vanpoucke, 2009).

In total, 320 farmers and 100 traders completed the survey questionnaires. Whenever sampled farmers had refused to fill the survey questionnaire for whatsoever reasons, the next farmers in the list were asked to fill the questionnaire. The detailed profiles of respondent farmers and traders were presented in Table 1.

Table 1. Respondents' profile.

Characteristics	**Malt barley farmers**		**Malt barley traders**	
	n	**%**	**n**	**%**
Gender distribution				
male	301	94.1	98	98
female	19	5.9	2	2
Age distribution				
≤20 years	2	0.6	2	2
21-40 years	202	63.1	68	68
41-50 years	72	22.5	23	23
≥51 years	44	13.8	7	7
Marital status				
single	16	5	6	6
married	288	90	92	92
divorced	8	2.5	0	0
widow/er	8	2.5	2	2
Educational status				
not educated	43	13.4	0	0
read and write	60	18.8	2	2
primary school	141	44.1	31	31
secondary school	65	20.3	58	58
college/university	11	3.4	9	9
Work experience				
≤5 years	41	12.8	36	36
6-10 years	120	43	34	34
11-15 years	43	13.4	25	25
16-20 years	54	16.9	3	3
≥20 years	62	19.4	2	2

In the study area, farmers produce malt barley along with other competing agricultural crops on an average landholding of 1.86 hectares. On top of that, the average productivity of malt barley is 2 tons per hectare which is lower compared to food barley (2.7 tons) and wheat (2.5 tons) in the study area. The malt barley productivity in the study area is far lower than it is for Europe (7 to 8 tons per hectare) due to poor supply of inputs, limited access to mechanized services, poor linkages along the chain and lack of incentives for farmers.

Data analysis

After data sorting, within-scale factory analyses (Lin *et al.*, 2005; Sezen, 2008) and Cronbach's alpha reliability estimate test (Lin *et al.*, 2005; Yu *et al.*, 2013; Zhao *et al.*, 2008) were performed. The factory loadings within-scale were computed to check the validity of all observable indicators to measure the intended multivariate latent variables. Cronbach's alpha reliability estimates, also called scales of reliability, were used to measure the internal consistency of indicators under a given construct. This is the measure of relatedness of the indicators to manifest a single construct they intend to measure. The summary of factor loadings and alpha reliability estimates for each construct are presented in Table 2. The within-scale factor loadings for all measurement indicators are greater than 0.70 except for PRF1 at farmers-traders interface and for PRF3 at farmers-cooperatives interface that loaded 0.645 and 0.690 respectively (Table 2). In past studies, factor loadings higher than 0.50 are assumed to demonstrate sufficient validity (Lin *et al.*, 2005; Yu *et al.*, 2013). Therefore, few observable indicators loading lower than 0.50 were dropped from further analyses (Table 2). Except for coordination of activities at the traders-malt factory interface, Cronbach's alpha reliability estimates are higher than 0.70 to reveal strong consistencies among observable items under each multivariate latent variable (Lin *et al.*, 2005; Zhao *et al.*, 2008).

In this study, structural equation modelling (SEM) technique was used for data analyses. This technique was chosen for its strength and suitability for the conceptual model developed for this study. As indicated by Tomarken and Waller (2005), SEM technique has the ability to specify latent variable models by providing separate estimates for the associations between latent variables and their manifest indicators (measurement models) and show the relationship among exogenous and endogenous latent variables (structural model); it always provides higher R^2 values compared to other techniques; and it provides more information on the relative strength of observed indicators to explain the latent variables as factor analysis is nested in it.

As noted by Nachtigall *et al.* (2003), model suitability can easily be checked by model-fit-statistics under SEM technique. Acceptable fit statistics somehow indicate whether or not (1) observable measurement items fairly manifest the intended latent constructs – measurement models; and (2) the data sets support the proposed associations between exogenous and endogenous variables – structural model (Figure 2). Though the SEM technique provides outputs for both measurement and structural models, outputs of the former were not reported since these outputs are quite similar to factor loadings reported in Table 2. Therefore, we presented only the model-fit-statistics and the path-coefficients of the structural models of the SEM technique.

Similar to the works of Wang *et al.* (2015), Won Lee *et al.* (2007), and Lin *et al.* (2005), four SEM diagrams were formulated at four interfaces (Table 3) along the MBVC based on farmers' and traders' data sets. In all cases, the models treat collaboration, commitment, coordination and joint-decision as latent-independent (exogenous) variables and VCP as latent-dependent (endogenous) variable. All measurement items with factor loadings of 0.50 or more were used to construct SEM diagrams and to run further analysis while other variables that loaded lower than the threshold were dropped (Table 3).

The SEM diagram at farmers-cooperatives interface was presented as a sample (Figure 2) though four SEM diagrams were formulated for the entire analyses. The summated median values for the set of observable indicators were used to explain multivariate exogenous and endogenous latent variables to run the models since summated mean values can only show the locations of estimates that do not exist among the five-point measurement scale (Molnar, 2010). Four separate SEM models were run, two for each data set to assess the relationship between four exogenous latent variables and an endogenous latent variable.

Table 2. Factor loading and the Cronbach's α estimates (farmers' and traders' survey).[1,2]

Code	Construct and item	F-interfaces		T-interfaces	
		F-C	F-T	T-F	T-AMF
	Collaboration (α scores)	0.792	0.791	0.733	0.828
CLB1	We and our partners form joint teams to work on common projects.	–	0.737	–	0.804
CLB2	We and our partners combine resources on common projects.	–	–	–	–
CLB3	We unreservedly share our knowledge with our partners.	0.810	0.792	0.751	0.814
CLB4	Our partners unreservedly share their knowledge with us.	0.868	0.812	0.867	0.747
CLB5	We and our partners expend joint efforts to improve our relations.	0.844	0.833	0.815	0.866
	Commitment (α scores)	0.817	0.810	0.882	0.701
CMT1	Our relations with our partners are based on mutual benefits.	–	–	0.873	–
CMT2	Our relations with our partners continue for a long future.	0.843	0.819	0.907	0.765
CMT3	We like to maintain our association with our partners.	0.843	0.831	0.753	0.855
CMT4	We are ready to invest in the relationship with our partners.	0.732	0.774	0.898	0.750
CMT5	We have stable relations with our partners.	0.792	0.769	–	–
	Coordination (α scores)	0.778	0.791	0.716	0.620
CRD1	We and our partners jointly manage our activities.	0.772	0.827	–	0.825
CRD2	We work closely with our partners for effective executions of activities.	0.771	0.777	0.885	–
CRD3	We and our partners always share activity schedule.	0.800	0.793	0.885	–
CRD4	We have clear guidelines for interactions with our partners.	–	–	–	0.825
CRD5	Our partners strictly follow our interaction guidelines.	0.759	0.726	–	–
	Joint decision-making (α scores)	0.812	0.807	0.849	0.816
JDM1	We and our partners jointly decide on product type.	0.837	0.831	0.901	0.800
JDM2	We and our partners jointly decide on process improvements.	0.880	0.897	0.877	0.902
JDM3	We and our partners jointly set product prices.	0.841	0.826	0.854	0.869
	Value chain performance (α scores)	0.743	0.834	0.711	0.707
PRF1	We improved product quality by working closely with our partners.	0.821	0.821	0.654	–
PRF2	We improved our responsiveness to customers by working closely with our partners.	0.727	0.727	0.843	0.821
PRF3	We enhanced our flexibility by working closely with our partners.	0.691	0.691	0.901	0.842
PRF4	We improved our efficiency by working closely with our partners.	0.785	0.785	–	0.761

[1] F-C = farmers-cooperatives interface; F-T = farmers-traders interface; T-F = traders-farmers interface; and T-AMF = traders-Assela malt factory interface.

[2] The empty cells had values lower than 0.50 and were dropped from further analyses.

The models were run on SPSS-AMOS version 22 statistical software (IBM, Armonk, NY, USA). The works of Yu *et al.* (2013) and Wang *et al.* (2015) were followed in which case the goodness-of-fit statistics of the models were assessed by (1) chi-square (χ^2); (2) normalized chi-square (χ^2/df); (3) comparative fit index (CFI); (4) root mean squared errors of approximation (RMSEA); and (5) incremental fit index (IFI). An acceptable χ^2 value relative to a given degrees of freedom measures how well the observed distribution of the data set fits the distribution that is expected if the variables are independent. This implies that the theoretical model significantly replicates the samples variance-covariance relationships in the matrix (Schumacker and Lomax, 2004). The CFI measures the improvements of non-centrality obtained by switching from one model to another. The RMSEA, also called discrepancy per degree of freedom, provides an indication of a discrepancy between observed and implied variance-covariance matrices (Hailu *et al.*, 2005). These goodness-of-fit statistics were computed at two interfaces each and presented in Table 4 for farmers and Table 5 for traders along with applicable threshold values.

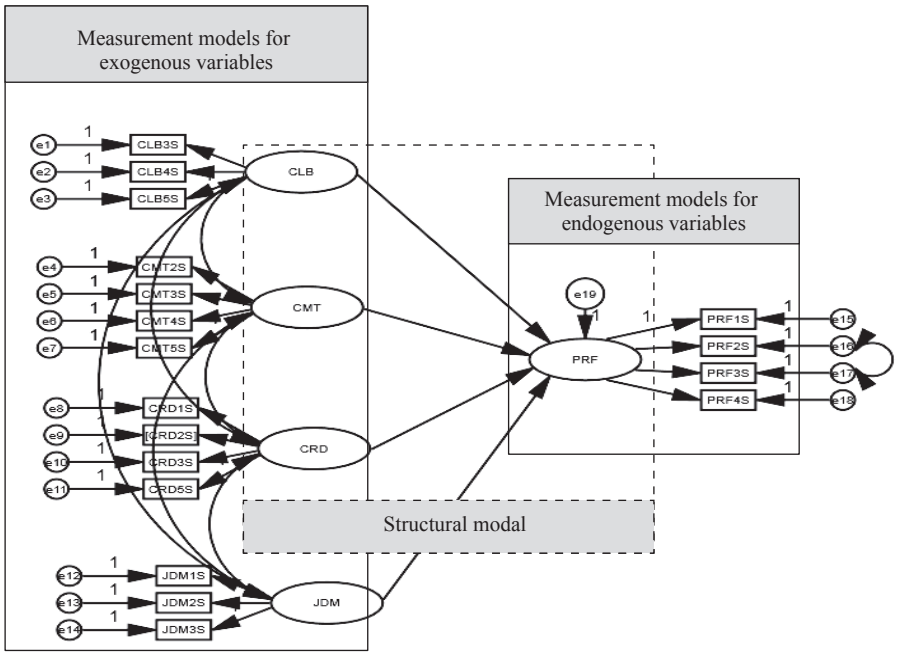

Figure 2. Structural equation modelling diagram at farmers-cooperatives interface. e1-e19: are codes for error variables; CLB3S, CLB4S and CLB5S are codes for observed indicators under collaboration (CLB) while CLB1S, CLB2S were dropped for loading low; CMT2S-CMT5S are codes for observed indicators under commitment (CMT); CRD1S-CRD5S are codes for observed indicators under coordination (CRD) while CRD4S was dropped for loading low; JDM1S-JDM3S are codes for observed indicators under joint decision-making (JDM); and PFR1S-PFR4S are codes for observed indicators under performance (PRF) (see Table 2 for explanation of the specific codes).

Table 3. Malt barley value chain integration interfaces.

Interface	
F-C	Farmers' perceptions about cooperatives' contributions towards MBVC performance
F-T	Farmers' perceptions about traders' contributions towards MBVC performance
T-F	Traders' perception about farmers contributions towards MBVC performance
T-AMF	Traders' perceptions about Assela malt factory's (AMF's) contributions towards MBVC performance

Table 4. Model fit statistics from farmers' survey (n=320).[1,2]

Statistics	**F-C interface**	**F-T interface**	**Threshold values**
χ^2	359.24	333.86	≤2,793.8
df	124	124	≤300
χ^2/df	2.897	2.692	≤5.00
CFI	0.915	0.926	≥0.90
RMSEA	0.077	0.073	≤0.08
IFI	0.916	0.927	≥0.90

[1] P<0.001.

[2] F-C = farmers-cooperatives interface; F-T = farmers-traders interface; threshold values adopted from Yu *et al.* (2013).

Table 5. Model fit statistics from traders' survey (n=100).[1,2]

Statistic	T-F interface	T-AMF interface	Threshold values
χ^2	141.67	134.19	≤2,793.8
df	79	78	≤300
χ^2/df	1.793	1.720	≤5.00
CFI	0.929	0.914	≥0.90
RMSEA	0.090*	0.085*	≤0.08
IFI	0.931	0.917	≥0.90

[1] P<0.001.

[2] T-F = traders-farmers interface; T-AMF = traders-Assela Malt Factory interface; * = values are slightly higher than the threshold values by Yu *et al.* (2013).

4. Results and discussions

According to SEM steps, the research hypotheses in this study can be tested once our survey data sets' goodness-of-fit to the SEM models are assured (Tables 4 and 5). The study findings were discussed in line with the proposed research hypotheses. Along with our conceptual framework presented in Figure 1, positive relationships between VCI dimensions and VCP were proposed at four interfaces (Table 3).

The goodness-of-fit statistics generated from SEM models based on farmers' and traders' data sets are within acceptable ranges, except RMSEA values computed at traders' interfaces. The RMSEA values at traders-farmers and traders-malt factory interfaces were 0.090 and 0.085 respectively (Table 5) which are slightly higher than the threshold value of 0.08 (Yu *et al.*, 2013). In order to improve models' goodness-of-fit, a double headed covariance arrow was drawn between two error variables, e16 and e17, in the SEM diagram (Figure 2) as hinted by the modification indices generated by SPSS-AMOS statistical software package (Janssens *et al.*, 2008; Wang *et al.*, 2015). The modification has reduced the χ^2 from 378.01 to 359.24 and RMSEA value from 0.080 to 0.077. Even though RMSEA values of ≤0.05 demonstrate the best model fit, still values between 0.05 and 0.10 are acceptable (Han, 2009). Therefore, the generated model-fit-statistics show that our survey data sets fit the models quite well, except the higher RMSEA value for traders' data set is slightly high probably due to the small sample size.

According to results of the structural models from farmers' data set, coordination (H_3) and joint decision-making (H_4) are the only exogenous variables that demonstrate significant positive correlation with performance at farmers-cooperatives with standardized path weights of 0.56 and 0.36 respectively. Similarly, commitment (H_2) has a significant positive relationship with performance at farmers-traders interface with standardized path weights of 0.62 (Table 6). The t-values for coordination (H_3) and joint decision-making (H_4) at farmers-cooperatives interface are significant at P<0.05, and t-value for commitment (H_2) at farmers-cooperatives interface is significant at P<0.01.

The t-values for other proposed associations between variables at farmers' interfaces are less than the minimum threshold of 1.96 which implies insufficient empirical supports (Janssens *et al.*, 2008). According to the standardized path weights for farmers' data set, coordination of activities (H_3), and joint decision-making (H_4) at farmers-cooperatives interface significantly correlate with VCP.

Interviewed cooperative staff also noted the existence of positive relationship between coordination of various malt barley farming related activities and performance at farmers-cooperatives interface. Moreover, they expressed that joint decision-making on the type, quantity, quality, terms of shipment of agricultural inputs improves performance at farmers-cooperatives interface. Therefore, active participation of farmers in the decision-making processes of cooperatives positively relates to performances. Consistent with the

Table 6. Results of structural model at cooperatives-farmers-traders interfaces (farmers' survey; n=320).[1]

Hypothesis: path	F-C interface		F-T interface	
	path coefficient	t-value	path coefficient	t-value
H_1: collaboration → performance	-0.22	0.948	0.20	1.077
H_2: commitment → performance	0.18	1.039	0.62	3.124**
H_3: coordination → performance	0.56	1.994*	0.18	0.685
H_4: joint decision-making → performance	0.36	2.427*	-0.22	1.524

*P<0.05; **P<0.01.

[1] F-C = farmers-cooperatives; F-T = farmers-traders.

finding of this study, Van Donk *et al.* (2008) noted a positive relationship between joint decision-making on inventory types and batch sizes and performance as it allows an extra flexibility to value chain members.

The fact that farmers' data set provided significant backing to the proposed positive relationships between coordination and performance statistically (H_3), joint decision-making and performance (H_4) at farmers-cooperatives interface and between commitment and performance (H_2) at farmers-traders interface goes hand-in-hand with the findings of past studies. For instance, Simatupang *et al.* (2002) noted a positive relationship between coordination and performance as coordination improves both flexibility and responsiveness. Similarly Stank *et al.* (2001) noted a positive correlation between coordination and performance as coordination reduces costs associated with duplication of activities and hence improves efficiency.

At farmers-traders interface, commitment towards long-term relationships has significant positive correlation with performance. In the view of interviewed farmers, most malt barley traders are egocentric who always try to maximize own interests at the expense of other value chain members with no commitment towards long-term relationships. Small-scale farmers and other interviewed chain members categorize egotism of traders as critical performance menace. In our opinion, the positive correlation between commitment and performance at farmers-traders interface is resulted from farmers' desire to work with committed traders. In line with this finding, Clarke (2006) noted a positive relationship between value chain members' commitment towards long-term relationships and performance as commitment reduces the time and costs associated with recurrent disputes, posturing and renegotiations. In the view of Morgan and Hunt (1994), commitment towards long-term relationships improves performance particularly when complemented with high level of trust and free information flow along the value chain.

On the other hand, many researchers noted the existence of positive relationship between collaboration between value chain members and performance (Cao and Zhang, 2010; Vereecke and Muylle, 2005), farmers' data set failed to support this hypothesis. Such a contradiction may be due the fact that MBVC members are unaware of the strategic importance of VCI to improve VCP. In the view of interviewed farmers, it was learnt that traders are egotist towards collaboration with farmers which has lowered performance. The malt factory considers traders as opportunists and always reluctant to engage them in any of its MBVC improvement programs. On the other hand, interviewed traders expressed their resentment about an exclusive strategy of the malt factory.

Contrary to our expectation, the path coefficients based on traders' data set are not statistically significant to support the proposed hypotheses at traders' interfaces (Table 7). Therefore, it is opined that traders' localized-thinking, non-inclusiveness, and egotism must have contributed to the lack of empirical support. In the view of interviewed malt factory managers, traders are self-seeking and mischievous who always try to serve their greedy profit motives. They, for instance, soak the malt barley in water to deceive the factory on weight and mix superior qualities/varieties malt barley with inferior one to cheat on price. In the view of Cao and Zhang (2010), egotistic actions of value chain members always diminishes VCP. It is harmony,

Table 7. Results of the structural model (traders' survey; n=100).[1]

Hypothesis: path	T-F interface		T-AMF interface	
	path coefficient	t-value	path coefficient	t-value
H_1: collaboration → performance	-0.78	1.724	-0.28	0.701
H_2: commitment → performance	0.45	0.808	-0.49	1.037
H_3: coordination → performance	0.47	0.530	0.25	1.344
H_4: joint decision-making → performance	-0.59	0.660	0.09	0.213

[1] T-F = traders-farmers; T-AMF = traders-Assela malt factory.

not isolation, of value chain members that would lead to superior VCP (Gellynck *et al.*, 2008; Vanpoucke, 2009). Moreover, the small sample size of traders could have influenced the statistical significance of the coefficients.

The malt factory managers express worries about the poor quality of malt barley supplied through traders which constitutes over 90% of the factory's malt barley purchases. Similarly, Yu *et al.* (2013) noted no significant correlation between VCI dimensions and VCP when value chain members are dissatisfied by low service level of chain partners. The study by Wiengarten *et al.* (2010) on collaborative value chain practices also reported no significant relationship between joint decision-making and VCP with poor information flow along the value chain. The traders' data set offered no support for the proposed relationships between variables, partly because of lack of awareness of members regarding these relationships.

Likewise, interviewed farmers strengthened managers' views by saying that traders adjust the measurement scale in order to read as low as 85% of the actual weight of supplied malt barley which is even difficult to control since the act is done mischievously. On the other hand, traders regard farmers' and the factory's accusations as character assassination which always threatens their long-term participation in the chain.

It is, however, interesting to point out that farmers' data set has moderately supported our hypotheses than traders' data set which failed to support even a single hypothesis. The varying recognition levels given to farmers and traders by the malt factory are suspected to cause perception differences. The malt factory has been providing several direct and indirect supports to farmers to improve their productivity and establish direct linkages or bridge through cooperatives, though this effort remained unsuccessful. Moreover, MBVC members have not yet started to consider VCI dimensions as part of their strategic means to revive the performance of the chain. Generally speaking, the findings of this study highlight the assertion that VCI dimensions do not always perceived to higher VCP, rather, it depends on the context of the value chain.

5. Conclusions and practical implications

This study provides better insights on the relationship between VCI dimensions and VCP based on the data sets from the MBVC in Ethiopia. The fact that very few of the proposed relationships received significant empirical support at the studied interfaces must be due to the particularity of the contexts in a country where the MBVC operates which makes the findings more interesting. The study hinted that the MBVC members, particularly farmers and traders, have not yet started to use VCI dimensions as part of their strategic means to revive VCP. In our views, the low level of maturity of the MBVC and lack of awareness of its members about the strategic importance of VCI dimensions to improve performance are the major contribution to the unique findings.

Among the hypothesized relationships, only coordination and joint decision-making at farmers-cooperatives interface and commitment at farmers-traders interface received significant empirical support to be positively related to VCP which show the entry points for interventions. The lack of empirical supports for the proposed

relationships, mostly at traders' interface, is mainly due to traders' feelings of exclusion from any VCI programs in addition to the effect of small sample size. The strategy that excludes traders cannot be successful as about 95% of malt barley is collected and supplied to the malt factory by them. The other MBVC members and relevant policymakers should look for policies and strategies that lead to better inclusiveness of traders so as to make them understand the importance of VCI for better performance. Otherwise, cooperatives organizations should be supported to replace traders for the collection and supply malt barley to the malt factory.

Though enforcing VCI dimensions can be too expensive, MBVC members had better include them in their strategic plans to revive performance. The huge agro-processors in the chain should create awareness among the upstream small-scale farmers and traders concerning the importance of VCI dimensions in this regard. Moreover, MBVC members and policymakers should establish salient 'rules of the game' at every stage of the chain to promote value chain-thinking and VCI practices to enhance performance. Though the use of data sets collected from a single agribusiness value chain in a developing country is an important empirical contribution by itself, more research should be done for better generalizability of the key findings to other agribusiness value chains in Ethiopia and even beyond.

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