

Examining the interface between supply chain governance structure choice and supply chain performances of dairy chains in Ethiopia

RESEARCH ARTICLE

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Abstract

Recently, the concept of supply chain management has been applied in the food chains with the idea of transforming agribusiness through networking and trustful partnership in the food chains. In this regard, it is important to consider the empirical knowledge of the interface among the variables of factors in the supply chain governance structure choices, the chain actors' choice of governance models, and the effects of these on the supply chain performances. The aim of this study was to empirically verify the relationships between factors existing in the business scenarios, the chain actors' governance structure choice, and supply chain performances of dairy chains in Ethiopia. The chains were assessed using the survey data that were collected from 215 chain actors and analyzed using structural equation modelling and IBM SPSS and IBM AMOS of version 24 software. The data collected were tested for the Cronbach's alpha reliability test for the internal consistency and using the different model goodness of fit measure tests. The results showed that the transaction cost, trust, and uncertainty significantly ($P < 0.001$) predicted the chain actors' supply chain governance model choice. On the other hand, uncertainty, willingness to collaborate, and collaborative advantages explained trust significantly ($P < 0.001$). The correlations analysis among the factors showed that there existed negative significant correlation between transaction cost and willingness to collaborate. The correlation between willingness to collaborate and collaborative advantages was found positive and significant. Similarly, the correlation between uncertainty and transaction specific investments was found positive and significant. Moreover, chain actors' supply chain governance structure choice significantly explained the supply chain performances, such as efficiency, flexibility, level of dairy losses, and level of integrations in the dairy chains. Promoting established dairy chain governance system, either through dependable relational governances or through formal contractual structure has been found improving the performances of the studied dairy chains.

Keywords: dairy, Ethiopia, supply chain governance structure, supply chain performance

JEL code: D23, D25, L14, M21, P11, P17, Q13, Q18

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1. Introduction

1.1 Background

In the current business arena, the relational view of competitive advantage is getting higher attention and acceptance in an academia and practice. In relation to this, the concept of supply chain management has already been applied to the food chain with the idea of transforming agribusiness through networking and trustful partnership in food chains. However, there are a lot of thoughts which need empirical evidence in order to understand and practice these ideas, particularly in less developed agro-value chains. Particular areas that need investigations are: (1) the interface among the variables of factors that have impact on governance structure choice (e.g. transaction-specific investments, transaction cost, uncertainty, etc.) and the choice of governance models (spot market, trust-based relational or formal contractual); and (2) the effect of the governance models choice on supply chain performance (efficiency, flexibility, quality, level of integrations, food losses, etc.) This study examined these interfaces using empirical evidence from the case study in dairy chains in Ethiopia.

1.2 Objectives of the study

The main objective of the study was to examine the interface between food supply chain governance structure choices and supply chain performances of dairy chains in Ethiopia.

The specific objectives were to:

1. analyze the interfaces among variables that could explain chain actors' supply chain governance choices;
2. study the factors that influence the chain actors' governance structure choice;
3. analyze how chain actors' supply chain governance choice explain supply chain performances; and
4. develop plausible recommendations for the improvements of the dairy supply chain performances using workable governance structures.

1.3 Literature review

■ Food supply chain governance structure choice

Food supply chain governance refers to the institutional framework in the supply chain, where transactions are negotiated and executed (Zhang and Aramyan, 2009). Humphrey (2001:22) defined the governance structure as, "the inter-firm relationships and institutional mechanisms through which nonmarket coordination of activities in the chain are achieved." According to the author, governance structure refers to a situation when some firms in the chain work according to parameters set by other firms in the chain. The parameters may include information about the product itself (what to produce), the production process (how to produce), the time it is needed (when to produce), the volume (how much to produce), and the price.

The theoretical building-blocks of governance structure choices in food chains

Whenever governance of food chains is discussed, important theoretical building blocks that may come to picture include concepts in the transaction cost economics (Wever *et al.*, 2010). Such concepts include bounded rationality, opportunism, transaction-specific investments, information asymmetry, and contracts. Hobbs (1996) stated that the first four of these as the key concepts for transaction cost analysis. However, it should be noted that transaction cost economics explanation is just one form of several explanations for governance choices. For more detailed perspectives related to governance choices, one may see Gereffi *et al.* (2005).

Transaction cost economics

According to Williamson (1999:1088), “Transaction Cost Economics (TCE) states that the transaction is the basic unit of analysis and an economizing response to the commons triple in governance: conflict, mutuality, and order.” TCE refers to the basic idea that the nature and level of transaction costs (search costs, bargaining/negotiation costs, and policing/enforcing costs) are determinant factors for supply chains governance structures. Transaction costs are also the bases for contract theory as transaction costs are the primary motives for vertical coordination in the supply chains (Frank and Henderson, 1992; Hobbs, 1996).

Bounded rationality

Although human beings are assumed to have an intention of making rational decisions, their ability to evaluate correctly all possible decision alternatives that could lead to rational decisions may be limited in reality, and this limitation is known as bounded rationality (BusinessDictionary, 2017). According to this online dictionary, “bounded rationality is a concept that decision makers (irrespective of their level of intelligence) have to work under three unavoidable constraints”, namely:

1. information constraint: it occurs when limited and often unreliable information is available regarding possible alternatives and their consequences;
2. human brain capacity: human mind has limited capacity to evaluate and process the information that is available at a time; and
3. time constraint: in most cases, only a limited time is available to make a reliable decision.

The above constraints force individuals to make satisficing instead of maximizing or optimizing (rational) choices in complex situations. In food supply chains, the governance choice is highly affected by bounded rationality. Particularly, in less developed food chains, like the one in this case study, it could be argued that information and time constraints could be the most constraining factors that contribute to high transaction costs.

Opportunism

According to Williamson (1999), opportunism is a risky situation that businesses and individuals seek to exploit the situations to their advantages. It is self-interest seeking, which may lack honesty. Hobbs (1996) stated that the risk of opportunism rises under certain situations in supply chains, where the bargaining power of chain actors is not equally distributed. For instance, when there are only a few buyers of a product from many suppliers, as in most agricultural produces in rural areas, the producers bargaining power may be limited. Hence, there is a high risk that the buyers may act opportunistically.

Information asymmetry

Information asymmetry is related to the first constraint of bounded rationality and opportunism described above. There are two major opportunism behaviors that are very common in literature resulting from information asymmetry. These behaviors are the adverse selection and moral hazard. According to Hobbs (1996), adverse selection or *ex-ante* opportunism refers to the hidden information prior to transactions with an intention of getting an advantage by one party to the transaction that intentionally hides the information for later use to its own advantage. But, moral hazard or *ex-post* opportunism arises because of the hidden behaviors and actions of individuals after transactions i.e. one party to the transaction may act opportunistically to increase own advantage. This is because their actions are not directly observable by the other party to the transaction. Opportunism as a result of information asymmetry could rather be other serious problems in less developed food value chains. This is because, in most less developed food value chains: (1) the system and technology for sharing information were not well developed; (2) there is no strict rule that requires an appropriate level of reliable information to be shared among the participants in the food chains; and (3) there could be a motive by the chain actors to divert information to mislead the partner in the chain and use it as

a means of exploiting each other. Opportunism and bounded rationality, which are the result of information asymmetry, contribute to transaction costs which were assessed under the transaction cost title in this study.

Transaction Specific Investments

Transaction specific investment (TSI), also known as asset specificity, is another important concept that could affect supply chain governance structure choice and relationships management. Zhang and Aramyan (2009) noted TSI as the acquisition of assets, which could be used only with one transaction partner or where it is costly and difficult to shift it and use for other purposes. According to Hobbs (1996:17), asset specificity occurs “when one partner to an exchange has invested resources specific to that exchange which have little or no value in alternative use.” In the agro-value chain, most investments are transaction specific and this has potential implications for food supply chain governance choice. Meanwhile, the choice could also motivate transaction specific investments.

Trust

Trust is “the firm’s belief that another company will perform actions that will result in positive outcomes for the firm, as well as not take unexpected actions that would result in negative outcomes for the firm” (Anderson and Narus, 1990:45). According to the authors, the firm’s belief strength in its working partner relations lead it to make a trusting response and commits itself to possible loss, depending on the actions of the relationship partner. In this study, trust was assessed as a single variable with the question: “in general how much trust do you have in your daily business customers and suppliers in your dairy supply chain?” where respondents were asked to rate from 0 to 100. Then the potential factors (uncertainty, collaboration advantage, and willingness to collaborate) expected to predict trusts were analyzed.

Trust is an important topic for discussion under supply chain management, where the relational view of business competitiveness is getting attention and providing rewards. Different authors discussed the importance of shift from resource orientation to network orientation for business successes. For instance, Lambert and Cooper (2000) stated that nowadays, businesses are in the era of inter-network competition, where individual business competition does not give much sense. According to the authors, the idea of overall chain value maximization is replacing the ‘resource based competitiveness’ view, which argued business success depends on access to important resources. The overall chain value maximization is supported by ‘relational view of competitiveness’, which argued “firm’s critical resources may span firm’s boundaries and may be embedded in interfirm resources and routines” (Dyer and Singh, 1998:660). The central point of supply chain management, as well as relational view of business competitiveness, is that business organization that forms smart partnerships, strategic alliances, and efficiently coordinate the value chains generates better overall supply chain performance than those striving separately (Junqueira, 2010).

Various studies (Fischer *et al.*, 2010; Schiefer *et al.*, 2009; Zhang and Aramyan, 2009) discussed the relationships among variables that determine the supply chain governance structure choice in food supply chains. The summary of the relationships among the variables was presented in Table 1.

■ Supply chain performance

Supply chain performance is an important issue to be scrutinized in the food supply chain management process. Supply chain performance refers to the overall chain performance which is dependent on performances registered at each stage of the supply chain (Aramyan, 2007). In order to identify the overall supply chain performances, performance measurement became an integral part of supply chain management. In this study, the supply chain performance indicators framework developed by Aramyan *et al.*, (2006) and Supply-Chain Operations Reference-model (Council, 2003) were adapted and used to evaluate the interface among supply chain governance structure choice and performance as measured by the performance indicators noted in these frameworks. One exceptional item considered in this study which was not part the previous literature

Table 1. Summary of few literatures on the relationships among factors in supply chain environment and governance structure choice.¹

Increases in factors	Possible governance structure				Literature supporting the relationships
	Spot-market relationships	Relational/oral agreements	Formal/written contracts	Integrations or strategic alliance	
1. Transaction costs: • Search costs (e.g. brokers' fee) • Information cost • Negotiation costs • Decision-making costs • Enforcement/monitoring costs	–	+	+	+	Loader, 1997; Sporleder, 1992; Zhang and Aramyan, 2009
2. Level of uncertainty • Environmental uncertainty • Behavioral uncertainty	–	+	+	+	Hobbs, 1996; Sporleder, 1992
3. Transaction specific investments: • Physical asset specificity • Human assets specificity • Relationship asset specificity • Location specificity	–	+	+	+	Hobbs, 1996; Sporleder, 1992
4. Level of trust • No trust • Trust to the level of fulfilling one's responsibility • Benevolence	–	+	–	–	Fischer <i>et al.</i> , 2007

¹ + and – refers to an increase and a decrease in the form of relationships as the result of an increase in factor under consideration, respectively. This shows the counter-move by chain actors to manage the situations in the environment.

to the researchers' knowledge was the inclusion of food loss as one performance indicator of the food supply chain. There are many performance indicators in the supply chain management. However, in this study, we considered some of the most important and relevant indicators, such as efficiency, flexibility, quality and safety, level of losses, and level of integration.

Efficiency

Supply chain efficiency measures how well the resources in the supply chain are utilized (Pettersson, 2008). Efficiency signifies a level of performance that describes a process that uses the lowest amount of inputs to create the greatest amount of outputs. Achieving efficiency of the supply chain would rather be a difficult task as much as it is important. This is because, the other objectives in the supply chain, such as responsiveness are contradicting with efficiency objectives. For instance, Randall *et al.* (2003) distinguished responsive and efficient supply chains. According to the authors, a responsive supply chain is characterized by quick response to customers demand and has short lead-time, small batch sizes, and often higher unit costs.

However, an efficient supply chain is differentiated by low cost per unit, but may be at an expense of responsiveness and characterized by longer lead-times, high set-up costs, large batch sizes and low unit costs. The efficiency-responsiveness comparison also extends to the lean-agile supply chain paradigms. The agile paradigm emphasizes on the quick responses to the fast-changing customer needs or responsiveness while the

lean supply chain focuses on reducing costs and waste across the supply chain, hence, more concerned with efficiency. Mason-Jones *et al.* (2000), argued against the general idea that agile manufacturing is adopted where demand is volatile and lean manufacturing adopted with functional products used for our basic needs such as food, which have stable demand. The authors argued that pursuing such arguments in an isolation condition may result in loss of the power of each paradigm and proposed a total supply chain strategy they termed as “Leagile” made from the combination the terms lean and agile emphasizing that supply chain strategy should balance both paradigms. The details of supply chain efficiency, responsiveness, and lean or agile were beyond the scope of this study.

The efficiency of the supply chain is a forefront issue in food supply chains management. Therefore, in this study, efficiency as one of the supply chain performance indicator was assessed against the chain actors’ supply chain governance choice using the cost and return relationships. It should be noted that, efficiency in context of this study refers to input-output relationships to achieve the objectives by the food supply chain actors for ease of measuring it. However, efficiency could be used in broader sense which may embed other performance indicators including responsiveness.

Flexibility

Flexibility could be considered as the ability to change or react to environmental uncertainties within less time, effort, cost, and without compromising overall performances. Calantone and Dröge (1999) stated that supply chain flexibility encompasses those flexibilities that directly impact a firm’s customers and are the shared responsibility of two or more functions along the supply chains. Stevenson and Spring (2007) after review of literature related to supply chain flexibility noted the following generic principles:

1. flexibility is multi-dimensional; and
2. different elements of flexibility are more important in certain environments than in others.

Flexibility is an important performance issue in food supply chains. This is because the seasonality of demand and supply of food commodities and short-shelf lives for the food commodities requires supply chains’ flexibility competences in terms of volume, price, and associated performances. In this study, flexibility was considered from the marketing point view and assessed on the basis of volume flexibility, delivery place flexibly, delivery time flexibly, and delivery price flexibly.

Quality and safety

It is a general consensus that food products nowadays could be consumed thousands of miles away from where they are produced. These modern food supply chains are responsible to deliver food products as quickly as possible to ensure certain levels of safety and quality, which can satisfy the growing needs of consumers. It is obvious that food quality and safety is important as much as its physical accessibility. As much as the food supply chain is expanding, the food quality, safety, and related standard scandals are also growing. In response to these scandals and the needs of consumers for safe and quality foods, an effective and credible food safety regulatory system became the critically important role for public policy makers and that of the supply chain actors (Hobbs *et al.*, 2002). According to the authors, designing a system that ensures the safety and quality of food in supply chain remains a challenge. Related to food safety and quality are the concepts of short-supply chain and traceability. Aung and Chang (2014) argued that the current food labelling system can’t guarantee food safety and quality. The authors believed good traceability systems helps to minimize the production and distribution of unsafe or poor quality products, thereby minimizing the potential for bad publicity and liability. In this study, quality and safety were analyzed from regulatory efforts perspectives. The chain actors were asked regarding the existence of product standards and related rejections, production process inspections, and product quality and safety inspections along the supply chain.

Level of losses

Parfitt *et al.* (2010:3066) defined food loss as “the general decrease in food quantity or quality, which makes it unfit for human consumption.” To the researchers’ knowledge, there is no literature which considered the food loss and waste along the supply chain as one indicator of the supply chain performances. However, food loss is one of challenges in food security endeavors and problems along the supply chains are the major reasons for food losses, particularly for developing countries (Kummu *et al.*, 2012; Parfitt *et al.*, 2010). Therefore, it was with this justification that level of dairy losses in this study were considered as elements of supply chain performances and analyzed against the chain actors’ supply chain governance choice.

Level of integrations

Integration is an important aspect of successful supply chains. “An integrated supply chain can be defined as an association of customers and suppliers who are using management techniques, work together to optimize their collective performance in the creation, distribution, and support of an end product” (Council, 2000:3). Supply chain integration is related to the very sense of supply chain management and to the relational view of business competitiveness. Due to this fact, some authors defined supply chain management as the process of integration of the activities in the supply chain. For instance, Handfield and Nichols (2002) defined supply chain management as the integration of the activities across the supply chain through improved supply chain relationships to achieve a sustainable competitive advantage. Supply chain integration affects operational performance, costs, and efficiency along the supply chain (Bagchi *et al.*, 2005). In this study, how the chain actors’ governance structure choice influences the level integration was evaluated. The level of integration was analyzed from the relationship among the chain actors point of view. The relationship of the focal firm with its suppliers and customers in terms of frequency of transactions, size of transactions (money and volume of transactions), betraying of transaction contracts, overall long time cooperation, and dependability on the relationships were evaluated through questionnaire against chain actors’ governance structure choice.

1.4 The literature gap and motivation of the study

Regardless of the vastness of research works dealing with food supply chain governance and supply chain performances, most of the literature described in the previous section lack some important aspects. The gaps include: firstly, most of the literature deal with either the governance part or the performance part overlooking the interconnectedness of the two. For instance, the study reported by Gellynck and Molnár (2009) focused on the determinant factors of the supply chain governance structure in European traditional food sector without link to supply chain performances.

Secondly, those who tried to discuss the links between governance structure choice and supply chain performances lack comprehensiveness particularly in the supply chain performance indicators addressed. Instead of using a number of supply chain performance indicators, the literature focused only on one or two performance indicators. Examples of such studies include: Vickery *et al.* (1999), which examined the flexibility aspect of supply chain performance and its impact on financial and market performances. Richey *et al.* (2010) made an explorative study that addressed the relations between supply chain integration and governance approaches, with particular emphasis on barriers to integration in supply chains. Gyau and Spiller (2008) discussed the impact of supply chain governance structures on the inter-firm relationship performance in agribusinesses categorizing the inter-firm relationships into two as behavioral relationships and economic relationship performances. The authors reported that economic relationship performance significantly depended on governance form. Panayides and Lun (2009) focused on the impact of trust on the innovativeness aspect of the supply chain performance and found that the existence of positive effects of trust on innovativeness of the supply chains. Stevenson and Spring (2007) attempted to explore the inter-organizational components of supply chain flexibility focusing on a flexible supply chain strategy with proactive means of reducing unwanted supply chain uncertainty and the roles of supply chain design, supply chain collaboration, and the inter-organizational information systems performances.

Thirdly, most literature, which tried to show the link between the supply chain governance choice and supply chain performance failed to address the link back to the scenarios in the business environment that influences the governance choice. That is, some literature lacked the interfaces back to the factors affecting the governance choices and focused only on the interaction between food supply chain governance choices and elements of the supply chain performance indicators. For instance, Wever *et al.* (2010) examined quality management system aspect of supply chain performance against governance structure choice in the context of the EU pork industry without due considerations on factors affecting governance choices.

Fourthly, many literature that deal with supply chain governance choice and supply chain performances focused on conceptual framework developments and needs to be supported with empirical evidences. Studies reported by Zhang and Aramyan (2009) and Aramyan *et al.* (2006) could be mentioned as an example in this regard.

Finally, to the researchers' best knowledge, there is no study that attempted to measure food losses as one indicator of supply chain performances in relation to food supply chain governance choices.

Therefore, this study attempted to show the factors that affect food supply chain governance choices and how the governance choices in turn affect food supply chain performances using comprehensive performance indicators. It has also attempted to explore the possibilities for reducing food losses through governance structure choice that has paramount contribution to empirical literature of the subject food supply chain management.

1.5. Hypotheses

The following hypothesis were developed and tested based on the summary of literature presented in previous sections (Table 1) and the motivation and objectives of this study to fill the research gaps. In the formulation of the hypothesis, the positive-negative relationships are defined based on the move towards the established governance forms (formal contractual or trust-based relational governance forms) as a reference point. That is, factors' effect towards the established governance forms and the established governance forms' effect on supply chain performance are used as a reference. For instance, Transaction costs negatively predict supply chain governance forms means lesser transactions costs are associated with the established governance forms and higher transaction costs are associated with the spot-market governance form. Supply chain governance choice positively predict supply chain efficiency means established governance forms are more efficient than the spot-market governance forms. Therefore, we ask readers to interpret the positive-negative relationships expressions in the hypothesis in this context. The hypotheses were classified into two major hypotheses with sub-hypotheses. The hypotheses were:

- H_A**: The scenarios in the supply chains affect chain actors' supply chain governance form choice.
 - H_{A1}**: Transaction costs explain (negatively predicts) chain actors' supply chain governance form choice.
 - H_{A2}**: Transaction specific investments explain (negatively predicts) chain actors' supply chain governance form choice.
 - H_{A3}**: Trust explains (positively predicts) chain actors' supply chain governance form choice.
 - H_{A4}**: Uncertainty explains (negatively predicts) trust.
 - H_{A5}**: Willingness to collaborate explains (positively predicts) trust.
 - H_{A6}**: Collaborations advantages explains (positively predicts) trust.
 - H_{A7}**: Uncertainty explains (negatively predicts) chain actors' supply chain governance form choice.
- H_B**: Chain actors' governance form choice affects supply chain performances.
 - H_{B1}**: Supply chain governance choice explains (positively predicts) efficiency of the supply chain.
 - H_{B2}**: Supply chain governance choice explains (positively predicts) flexibility of the supply chain.
 - H_{B3}**: Supply chain governance choice negatively affects level of dairy losses in the supply chain.

H_{B4} : Supply Chain governance choice positively affects quality and safety in the supply chain.

H_{B5} : Supply chain governance choice positively affects the level of integrations in the supply chain.

2. Methodology

2.1 Study site

This study was conducted in the central part of Ethiopia, East Africa. Figure 1 presents the routes of the dairy chains to the capital of Ethiopia, which were assessed.

2.2 Analysis and study structure

Five major milk delivery chains to Finfinnee, the capital of Ethiopia, were assessed (Figure 1). These were: Ambo/Holota – Finfinnee, Bishoftu – Finfinnee, Sabata-Finfinnee, Aleltu – Finfinnee and Salale/Chanco – Finfinnee milk chains. These chains are the only formal milk sheds that feed the capital's dairy products demand in addition to import from abroad. In this study, the interaction among dairy farmers, dairy cooperatives, dairy traders, processors/dairies, and supermarkets was evaluated for the chains. The hypotheses presented under section 1.5 were structured and presented in Figure 2, which depicted the Structural Equation Model (SEM) of this study. The left to middle view of Figure 2 shows the basic factors for governance structure choices, which were selected for this study, i.e. Transaction Cost (TC), Uncertainty (U), Trust (T) and, Transaction Specific Investments (TSI) and additional two variables, Collaborative Advantages (CA) and Willingness to collaborate (WC) which together with Uncertainty expected to explain Trust. Figure 2 shows also how these factors play role in the chain actors' governance structure choice. The Figure also depicts how the factors are correlated with each other.

These basic factors were measured based on the questions formulated in the questionnaire (Supplementary Materials S1). For example, Transaction Cost was measured by ten elements of the questionnaire as listed under section B of Materials S1. The sum score for each respondent was used for analysis, i.e. for Transaction Cost as the highest score for an individual for each of the question was 5. This means that the highest score for the 10 questions could be 50. Looking from the middle to the right in Figure 2, the illustration made was to explain the impact of the supply chain governance choice on supply chain performances.

In this study, Efficiency (E), Flexibility (F), Quality and Safety (QS), Level of Integration (LI), and Level of dairy Losses (L) were selected as basic supply chain performance indicators for the assessment. Efficiency and loss were measured on the absolute values of the data obtained from the respondents. The total cost divided by total revenue for each respondent was used as a measure of efficiency. Only operational costs of a single year were considered against the revenue of a year. For the other performance indicators, the sum score for each respondent was used for analysis. In case of Flexibility and Quality & Safety, even though the data was collected using binary response questions, they were converted to Likert scale rating based on the

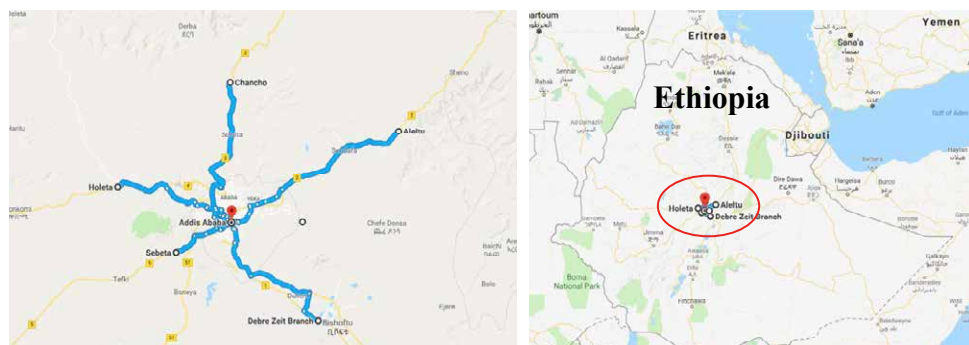


Figure 1. The geographical location of the study site: the route assessed (left), Ethiopia (right).

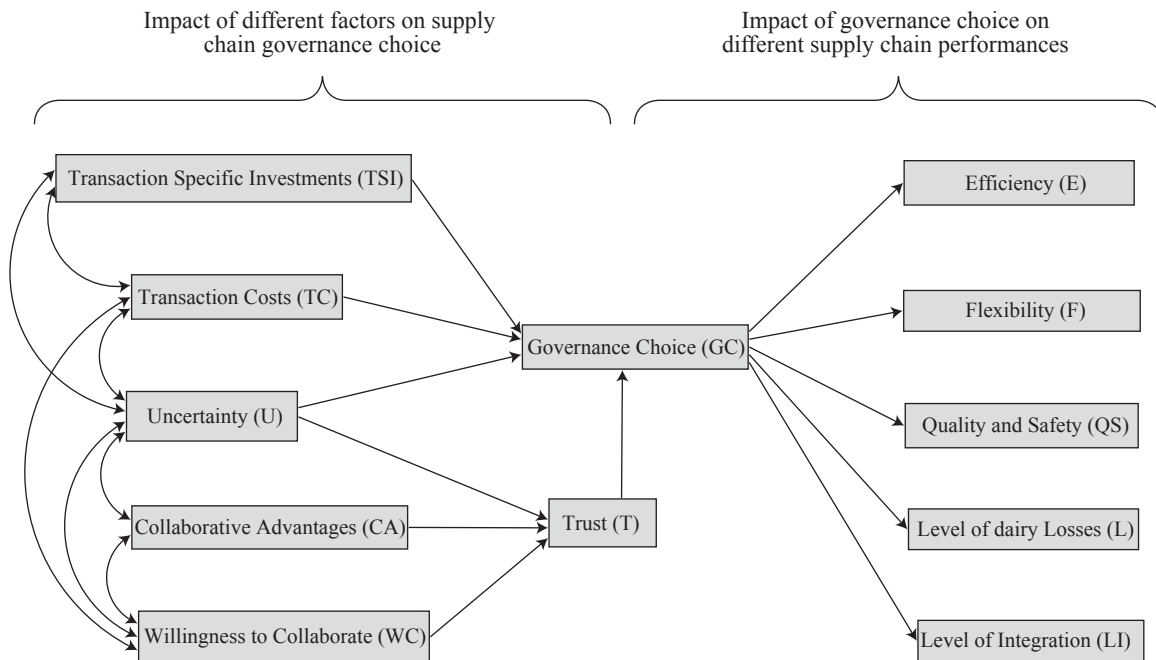


Figure 2. Structure of the study showing the paths of analysis (produced by Amos Graphics version 24).

questions asked in order to fit to the model for analysis, for this procedure, see Supplementary Table S1. The one side arrow shows that the factor is measuring /causing the other factor to happen where the direction of the arrow shows the cause-effect (tail-head) relationship. On the other hand, double-headed arrows between the factors show that the factors are correlated without referring to the cause-effect relationship. The path analysis in Structural Equation modeling was employed. IBM SPSS version 24 (IBM Corporation, Armonk, NY, USA) and IBM SPSS AMOS version 24 software were used in the analysis.

SEM is a statistical modelling technique which is used for analyzing multivariate data that has been long known in behavioral science particularly, appropriate for theory testing (Hox and Bechger, 2007; Savalei and Bentler, 2010). Jais (2007:97) defined SEM as “a class of methodology that seeks to represent hypothesis about the means, variances and covariance of observed data in terms of smaller number of structural parameters defined by hypothesized underlined model.” According to the author, SEM is a system that stems from econometrics but increasingly applied in various business-related disciplines and behavioral disciplines such as psychology, sociology, political science, and education. Many researchers (Cousins *et al.*, 2006; Ji *et al.*, 2012; Lado *et al.*, 2008; Maloni and Benton, 2000; Ryu *et al.*, 2009; Stank *et al.*, 1999, 2001; Wisner, 2003) used SEM in the areas of supply chain governance and performance researches. It is with its justifiable benefit (comprehensiveness, testability, graphical representations, and solutions through the use of purpose-based software, in this case, IBM AMOS) and relevance of the model to test the study hypothesizes that this model was selected for this study.

2.3 Data sampling

Purposive sampling technique was used based on the level of participation and willingness to collaborate with the chain actors. The study attempted to include all relevant chain actors as presented in Table 2. Purposive sampling was used to select those chain actors, who have relatively long experience in the selected dairy supply chains and those who could explain their governance choice, the scenario in their business environments, and their experience in relations to the supply chain performances. Willingness to collaborate was another important factor that obliged the researchers to use purposive sampling.

Table 2. Sample size by chain actor category.

Chain actor categories	Number of sample size considered	Number subjected to analysis
Dairy farmers	120	113
Dairy traders	80	73
Dairy processors	8	8
Dairy primary cooperatives	6	6
Dairy union	3	3
Supermarkets	12	12
Total respondent	229	215

Note that, for this study, only peri-urban and urban dairy farmers and large-scale dairy farming organizations that constituted the formal dairy supply chain around the capital of Ethiopia were considered. In the process of data clearing, out of the 229 samples taken only 215 respondents' responses were subjected to analysis. Due to the fact that the numbers of the institutional respondents were small for separate analysis, the data were analyzed altogether. Even though, the questions asked all chain actors were the same for the sake of comparison and integration of the results. However, the separate analysis could give better insight to each category of chain actors, therefore, we ask readers to note this as a limitation of this study. This could encourage future study with more sample size in each category which could be subjected to model-based data analysis representing categories across the chain.

2.4 Data collection protocol

The data collection protocol (Materials S1) was adapted from (Ji *et al.*, 2012) for the supply chain governance part and developed based on the framework given by (Aramyan *et al.*, 2006, 2007). Some elements of the Supply Chain Operations Reference model (Council, 2003) for measuring supply chain performance part were also used. These data collection protocols were adapted because they were developed sufficiently to be customized and fit to any food chain in any places. Before adapting the tools, care was taken to make sure they fit with the present study evaluations.

2.5 Model diagnosis

Two types of model diagnosis were made before running the SEM model. Firstly, variables which were used as predictor components in SEM were developed from sum scores of the elements of the questionnaire. In this regards, Cronbach's Alpha was used as it is one of the most commonly used statistics for reliability test (Bland and Altman, 1997b; Peterson, 1994). The Cronbach's Alpha values of all summated variables were given in Supplementary Table S2. All, except one of the Cronbach's Alpha values are greater than 0.7. Kaplan and Saccuzzo (1982) as cited in Peterson (1994) recommended Cronbach's Alpha of 0.7 to 0.8 for basic research and 0.95 for applied research. Bland and Altman (1997a) noted also for comparing groups, Cronbach's Alpha values of 0.7 to 0.8 were regarded as satisfactory and the minimum value of 0.90 was desirable for the clinical application. Therefore, based on Cronbach's Alpha values, the internal reliability of all the summated variables in this study were proved acceptable for further analysis. Note that Cronbach's alpha is a measure of internal consistency, i.e. how closely related a set of items are as a group. Hence, the differences in the elements of the questionnaire used as predictor variables do not make differences. Whatsoever, the number of the question used should be, the Cronbach's alpha value needs to be fairly high to the standard.

Secondly, different commonly used Goodness of fits test parameters were used (Supplementary Table S3). As it can be noticed from Table S3, the Chi-square statistics values, goodness of fit of 0.85, CMIN/DF (minimum value of the discrepancy divided by its degrees of freedom) ratio of 4.7, root mean square error of approximation of 0.13, and other test results showed that the model fits more-or-less the data, see, Ji *et*

al., (2012). Bagozzi and Yi (1988) recommended additional preliminary goodness of fits evaluation criteria that include the process of examination of the existence of irregularities against common standards. Using authors' own words, "testing of anomalies", which include correlations greater than one, extremely large parameter estimates, negative error variances. In this study, the model was tested for such irregularities and there were no such problems observed. Hence, statistical testing of the hypotheses using the model is justifiable.

3. Results

3.1 Model results-the standardized estimates

Figure 3 reports the results of the model path analysis. As it can be noted from the path analysis of the associated standardized regression weights (Table 3), most of the hypotheses were confirmed as formulated. However, two of the hypotheses were not confirmed with the required statistical significance. Note that the significance threshold for this study was set at the P -value of 0.05. In Tables with the P -values, the P -values given as three asterisks (***) refer to the P -value of less than 0.001.

The results from SEM path analysis were reported on Figure 3, where the interfaces among chain actors' supply chain governance choices and the supply chain performances are shown. According to the result, transaction costs, uncertainty, and trust appear to influence chain actors' choice of the governance structure. From the result in Figure 3, trust, on the other hand, is predicted by collaboration advantages, uncertainty, and willingness to collaborate. The effect of governance choice on supply chain performances was clear as depicted on the results in Figure 3. The chain actors' governance structure choice appears affecting almost all the supply chain performance indicators selected in this study (Figure 3).

3.2 Tests of hypotheses

The results in Figure 3 show how the factors in the business scenarios influencing the chain actors' governance structure choice and the impact of the chain actors' governance structure choice on supply chain performances. However, in order to test the hypothesis using the SEM results, we need to review the regression weight

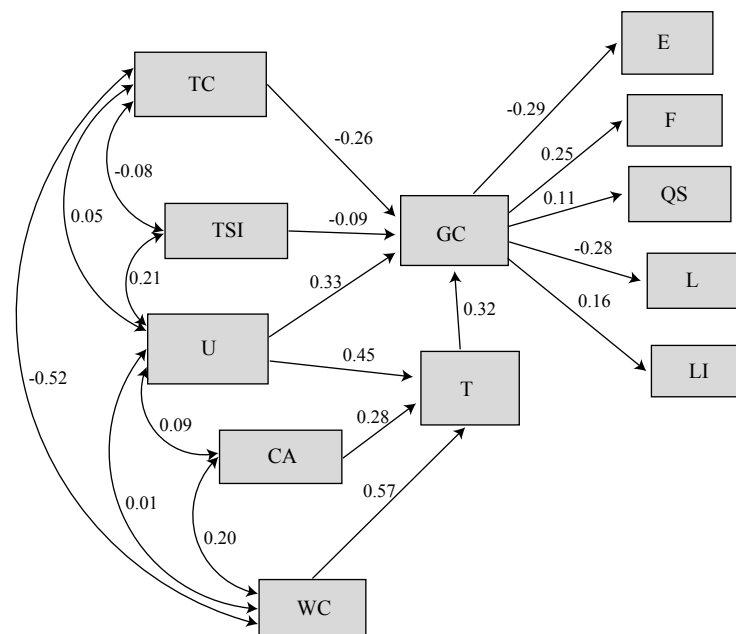


Figure 3. Structural equation modelling path analysis standard estimate results.

estimates of the study which are presented in Table 3 with their respective *P*-values. Based on the results in Table 3, the hypotheses test results were presented in Table 4.

According to the results in Table 3, based on the estimating coefficient and *P*-value, it could be visible how factors are influencing the other factors with the level of significances. Collaborative advantage (CA), willingness to collaborate (WC), and uncertainty (U) predicted trust (T) significantly ($P < 0.001$). Similarly, trust, transaction costs (TC), and uncertainty (U) explained chain actors' governance choice (GC) significantly ($P < 0.001$). On the other hand, efficiency (E), Flexibility (F), and level of losses (L) are significantly ($P < 0.001$)

Table 3. Governance structure and performance interfaces regression weights.

	Related variables	Estimate/co-efficient	<i>P</i> ¹
Factors determining trust	T ← CA	0.276	***
	T ← WC	0.566	***
	T ← U	0.446	***
Factors determining chain actors' supply chain governance choice	GC ← TSI	-0.094	0.086
	GC ← T	0.316	***
	GC ← TC	-0.262	***
	GC ← U	0.328	***
The impact of supply chain governance choice on supply chain performances	E ← GC	-0.286	***
	F ← GC	0.254	***
	QS ← GC	0.107	0.116
	L ← GC	-0.278	***
	LI ← GC	0.159	0.019

¹ *** = significant at $P \leq 0.001$.

Table 4. Tests of hypotheses of the study.

No	Hypotheses content	Decision-based on model result
H _{A1}	Transaction cost explains (negatively predicts) chain actors' supply chain governance form choice	Confirmed
H _{A2}	Transaction specific investment explains (negatively predicts) chain actors' supply chain governance form choice	Not confirmed
H _{A3}	Trust explains (positively predicts) chain actors' supply chain governance form choice	Confirmed
H _{A4}	Uncertainty explains (negatively predicts) trust	Confirmed
H _{A5}	Willingness to collaborate explains (positively predicts) trust	Confirmed
H _{A6}	Collaborations advantages explains (positively predicts) trust	Confirmed
H _{A7}	Uncertainty explains (negatively predicts) chain actors' supply chain governance form choice	Confirmed
H _{B1}	Chain actors' supply chain governance choice explains (positively predicts) efficiency of the supply chain	Confirmed
H _{B2}	Chain actors' supply chain governance choice explains (positively predicts) flexibility of the supply chain	Confirmed
H _{B3}	Chain actors' supply chain governance choice negatively affects level of dairy losses in the supply chain	Confirmed
H _{B4}	Chain actors' supply chain governance choice positively affects quality and safety in the supply chain	Not confirmed
H _{B5}	Chain actors' supply chain governance choice positively affects the level of integration in the supply chain	Confirmed

predicted by chain actors' supply chain governance choices. Governance choice also explained the level of integration significantly ($P < 0.05$). Contrary to the hypotheses, TSI fails to predict the chain actors' governance choice, i.e. the regression weight for TSI in the prediction of GC is not significantly different from zero at 5% significance level. Similarly, chain actors' supply chain governance choice has no significant influence on the situation of dairy quality and safety (QS) issues in the chain as per the results in Table 3. These results in Table 3 are summarized to test hypotheses of the study in Table 4.

In relations to these findings, the direct effect of factors in the business scenarios on supply chain performances may be of interest. Accordingly, the model was run to check this direct effect of the factors on performances. The result showed (Table 5) that the direct effect of transaction costs on efficiency, level of losses, and level of integrations and the direct effect of trust on all the performance indicators used in this study were found statistically significant. The other factors direct effects on the performances were not significant.

3.3 Correlations among governance determining variables

Table 6 shows the correlations among the factors explaining governance structure choice in relation to the P -values. As indicated in Table 6, there existed negative significant correlations between the transaction costs (TC) and the willingness to collaborate (WC) ($P < 0.001$). Similarly, a positive significant correlation between willingness to collaborate and collaborative advantages (CA) ($P < 0.05$) was found. The positive correlations between transaction specific investments (TSI) and uncertainty (U) was also found significant ($P < 0.05$). The correlations among the other factors presented in Table 6 were not statistically significant at the P -value of 0.05 or less. For details on the behavior of the relationships among these variables, see the scatterplot matrix of these variables in Supplementary Figure S1.

Table 5. Direct effect of factors in the business environment on supply chain performances – regression weights.

	Related variables			Estimate	P^1
Direct effect of transaction costs on supply chain performances	E	←	TC	0.017	***
	F	←	TC	-0.004	0.658
	QS	←	TC	0.012	0.244
	L	←	TC	0.033	0.034
	LI	←	TC	-0.081	***
Direct effect of transaction specific investments on supply chain performances	E	←	TSI	0.010	0.215
	F	←	TSI	0.033	0.090
	QS	←	TSI	0.009	0.692
	L	←	TSI	-0.006	0.867
	LI	←	TSI	0.080	0.080
Direct effect of uncertainty on supply chain performances	E	←	U	0.009	0.180
	F	←	U	-0.025	0.127
	QS	←	U	-0.035	0.066
	L	←	U	-0.009	0.748
	LI	←	U	-0.016	0.679
Direct effect of trust on supply chain performances	E	←	T	-0.013	***
	F	←	T	0.054	***
	QS	←	T	0.023	0.011
	L	←	T	-0.040	0.004
	LI	←	T	0.047	0.010

¹ *** = significant at $P \leq 0.001$.

Table 6. Correlations (group number 1 – default model).

Related variables	Estimate/co-efficient	P^1
TC ↔ TSI	0.082	0.158
TC ↔ U	0.047	0.484
TC ↔ WC	-0.522	***
CA ↔ WC	0.195	0.001
U ↔ WC	0.012	0.852
CA ↔ U	0.094	0.160
TSI ↔ U	0.214	0.002

¹ *** = significant at $P \leq 0.001$.

4. Discussions

The findings of this study were more-or-less in confirmation of the transaction cost economics theories of supply chain governance choices. This study tried to explore the bridge of chain actors' supply chain governance structure choice to the performances of the supply chain. In supply chain management, the goal is not about the supply chain governance choice rather it is to improve the overall performances of the chain, which is dependent on performances at each stage of the supply chain. In the following paragraphs, the present study results' theoretical implications and meaning was discussed relating to the existing literature.

4.1 Transaction cost versus chain actors' supply chain governance choice

In this study, it was found that transaction cost explained chain actors' supply chain governance choice significantly ($P < 0.001$). This is in line with the theories dealing with transaction costs. Transaction costs explain governance choice due to the fact that businesses in the supply chain always intend to make rational choices; even though, the choices are limited by bounded rationality. Williamson (1979) stated that governance structures are regarded as part of the optimization of rationalization problem as the shift from one structure to another may permit a reduction in transaction costs. The author discussed this matter in relations to possibilities of reducing the costs associated with writing complex contracts, costs of effecting the contracts, and reducing of *ex-post* opportunism or moral hazard.

In this study, governance structure choice varied among three alternatives: spot-market, relational, and formal contractual governances. As it was reported in Figure 3, most of the hypotheses that were stated as factors expected to predict chain actors' governance choice were confirmed (Table 3). The meaning of this result could be understood from transaction costs analysis theories. In order to understand the specific variability between transaction costs and chain actors governance structure choices, besides the SEM model results, the scatterplot matrix of the variables expected to explain the chain actors' governance structure choice were depicted (Figure S1). According to the result, as the transaction costs increase the governance choice shifts from the high score (3-formal contractual) to medium score (2-informal relational), and to low-score (1-spot-market). From this, it can be implied that the chain actors who shifted from spot-market to relational or formal contractual governance structures have managed to reduce transaction costs. Note that in this case the supply chain governance structure choices were reduced only to three options based on the results that these are the only prominently existing choices in the dairy chain studied. However, different authors discussed different governance structure types. For instance, Gereffi *et al.* (2005) identified five value chain governance types based on the complexity of transactions, ability to codify transactions, capabilities in the supply base, and degrees of explicit coordination and power asymmetry. For more details of possible governance forms and associated issues one may refer to the works by (Gereffi *et al.*, 2005; Gyau and Spiller, 2008; Hobbs, 1996).

4.2 Transaction specific investments versus chain actors' supply chain governance choice

Another important concept in the process of chain actors' governance structure choice is transaction specific investments or asset specificity. In this study, a transaction specific investment was found significantly correlated with uncertainty. Uncertainty, on the other hand, was found significantly predicting chain actors' governance choice and trust. Even though transaction specific investment's direct prediction on chain actors' governance choice was not confirmed in this study, some studies (e.g. Rokkan *et al.*, 2013) discussed transaction specific investments as important components of firms' marketing strategies to explain chain actors' governance choice. On the other hand, most literature in transaction cost economics also considered transaction specific investments as strongly correlated to transaction costs (Hobbs, 1996; Ji *et al.*, 2012; Loader, 1997). This could be the reason that the transaction specific investments hypothesis was not directly confirmed by this study since it is correlated to the other factors. Of course, from the general knowledge in multiple regression analysis, if two predicting variables are strongly correlated, none of them may give a significant unique variance in explaining the dependent variable. In this case, the correlation between transaction specific investment and uncertainty was also found positive and statistically significant. The prediction of uncertainty on trust is also statistically significant implying that transaction specific investments and trust could be correlated. These could be the reason that transaction specific investment's direct prediction on governance choice was not confirmed.

4.3 Trust versus chain actors' supply chain governance choice

In this study, it was found that trust significantly predicted chain actors' supply chain governance structure choice. Trust was also significantly predicted by uncertainty, willingness to collaborate, and collaboration advantages. Many authors (Delbufalo, 2012; Fawcett *et al.*, 2012; Ghosh and Fedorowicz, 2008; Kwon and Suh, 2005; Laeequddin *et al.*, 2010; Panayides and Lun, 2009; Sahay, 2003) discussed trust as the vital issue influencing relationships in supply chains. In summary of the literature, trust determines many aspects including how chain actors choose the governance structure. On the other hand, trust develops over time and is dependent on scenarios in the business environments. Here, it is also very important to note the bidirectional influence of factors in food value chains on each other. For instance, it is logical to think of trust also influences willingness to collaborate. Fawcett *et al.* (2012) argued that trust is the foundation for building and sustaining collaborative alliances in the supply chain. According to authors, trust in the supply chain can grow if and only if partners wish to build it and are willing to invest in its signals that create mutual confidence.

The willingness to collaborate and the collaboration advantages discussed in this paper are concepts similar to partners' wish to increase trust and willing to invest to build it in Fawcett *et al.*, (2012) work, and it is also in confirmation of it. Panayides and Lun (2009) also argued trust is a significant predictor of relationships performances. On the other hand, Kwon (2005) used SEM and assessed factors explaining trust and how trust influences the degree of chain actors' relationships commitments. According to the author's work, trust significantly and positively influenced the degree of chain actor's relationships commitments. The present study is in confirmation of this work as trust was found significantly predicted by uncertainty and it predicted chain actors' supply chain governance choices significantly.

4.4 Uncertainty versus chain actors' supply chain governance choice

In general, the lesser uncertainty, the better would be the trust on relationships among chain actors. On the other hand, high uncertainties may create poor relationships along the supply chains. Therefore, uncertainty has paramount implications in chain actors' supply chain governance choice. In this study, it was found that uncertainty significantly predicted the level of trust among the chain actors. Moreover, uncertainty significantly explained chain actors' choice of governance structure. Note that the estimates of uncertainty to trust and governance choice were both positive due to the fact that higher score was given for lesser uncertainty (Materials S1 – Section D). This means, as the uncertainty increase trust decrease. Higher

uncertainty is associated with spot-market governance choice. Chain actors who made established relational or formal contractual governance form have managed to reduce uncertainty. The main problems associated with uncertainty in supply chain relationships management are the opportunism discussed by Hobbs (1996).

4.5 Chain actors' supply chain governance choice versus supply chain performances

This study showed chain actors' supply chain governance choices significantly influencing the supply chain performances. Efficiency, flexibility, level of losses, and level of integrations were significantly explained by chain actors' governance choice. These were the expected results as per the study hypothesis and are more or less consistent with few researchers' work. For instance, Gyau and Spiller (2008) stated that in spot-market governance forms, chain actors are likely to act opportunistically in order to maximize short-term benefits and may incur costs to safeguard themselves against these opportunistic behaviors (increase transaction costs), hence the overall economic performance of the supply chain may be reduced. The authors showed that chain actors' governance structure choice significantly predicted efficiency (cost reduction) and overall financial success. Wisner (2003) noted increasing the value of products and services to customers in the supply chain with the lower costs as the main aim of SCM. Stevens (1989) discussed the importance of supply chain integrations in general as crucial issues for businesses competitiveness. According to Stevens (1989), businesses could obtain benefits resulting in increased market share with a lower assets base if they recognize and manage the inter-relationships between component parts of the supply chain and ensuring a good fit between its design and operation and with their competitive strategy. Prajogo and Olhager (2012) noted that long-term relationship between supply chain partners has a vital role in enhancing the logistics integrations activities concerning the flows of physical materials and information and ultimately improves competitive performances. The finding of this study was found consistent with these studies. Note that chain actors' governance choice prediction on efficiency was negative due to the fact that efficiency was measured as cost to revenue ratio, which implies less value of the ratio means high efficiency. It could be argued that, through improving relationship management in the supply chains, it is possible to improve supply chain performances including reducing food losses in the supply chains.

On the other hand, the factors in the business scenario could directly also influences supply chain performances. In this study the direct effects of transaction costs on efficiency, level of losses, and level of integrations and the direct effects of trust on all the performance indicators used were found significant.

5. Conclusions

This paper has attempted to examine how various factors in the business scenario of the dairy chain in Ethiopia explain chain actors' supply chain governance choice and how chain actors' governance choice, in turn, predicts supply chain performances. Accordingly, the following important findings were identified:

- Transaction costs explained chain actors' supply chain governance choice. Chain actors who moved from spot-market structure to either relational or formal contractual governance structure appeared that they have managed to reduce transaction costs.
- It was found that trust significantly predicted chain actors supply chain governance choice. That is, as trust builds up, chain actors move towards established relationships (relational or formal contractual) from spot-markets governance structure.
- Uncertainty, willingness to collaborate, and collaborations advantages explained trust. The higher the uncertainty in the chain, the lesser would be the trust. As collaborative advantages among the chain partners and their willingness to collaborate increase, trust builds up.
- Uncertainty explained chain actors' supply chain governance choice. High uncertainty was associated with spot-market governance structure.
- There existed significant negative correlations between transaction costs and willingness to collaborate. Similarly, a positive correlation between willingness to collaborate and collaborative advantages was found significant. The positive correlation between uncertainty and transaction specific investments was also found significant.

- Chain actors' supply chain governance choice explained the efficiency of the supply chain. The spot-market structure appeared less efficient than relational or formal contractual structures.
- Chain actors' supply chain governance choice explained flexibility of the supply chain. Relational and formal contractual governance structures appeared more flexible governance structures than spot-market structure.
- Chain actors' supply chain governance choice affected the level of dairy losses in the supply chain. Higher losses were associated with the spot-market structure.
- Chain actors' supply chain governance choice affected the level of integration in the supply chain. More supply chain integrations were identified with relational and/or formal contractual governance structures.

Recommendations

There are several ways in which our findings could support the chain actors, policy makers, and other stakeholders dealing with improving dairy chains in Ethiopia. To this end, the policy makers and chain actors need to work on supply chain governance choices, which are dependent on factors in the business environment. Stronger partnership arrangements are needed among the dairy chain actors which could be achieved through intensive works on the scenarios in the dairy business environments. For instance, the chain actors may establish a platform where they can share information and experiences, which could also help to develop trust. The public sector and other stakeholders may also need to work on reducing uncertainties resulting from policy interventions. Attention also needs to be paid to maintaining or improving the intrinsic rewards from working in collaboration in the food chain by concerned stakeholders. In relations to this, awareness creations are needed for stakeholders as to how established governance systems are rewarding the whole chain. In general, an important concern should be on how to improve trust among the chain actors, reduce transaction costs, and reduce uncertainty which in turn will have an improving effect on supply chain performances including reducing dairy losses in the chain.

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Supplementary material

Supplementary material can be found online at <https://doi.org/10.22434/IFAMR2018.0001>.

Materials S1. Data collection protocol.

Table S1. Binary response questions converted to 5-point Likert scale.

Table S2. Summary of Cronbach's Alpha reliability test results.

Table S3. SEM Model goodness of fit results against acceptable values.

Figure S1. Scatterplot matrix.

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