

# Identifying Global Value Chain Governance Determinants in Kenya's Horticultural Oriented Export Sector by Nonlinear Principal Component Analysis

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## ABSTRACT

The objective of this work is to empirically assess the determinants used in global value chain governance trade through interfirm relationship and their effect on competitive advantage of horticultural value chains in developing economies. The paper is based on a Kenyan survey of 83 horticultural exporters of fresh fruits and vegetables accessed out of 120 exporters registered with Fresh Produce Association of Kenya (FPEAK) and Horticultural Crops Directorate (HCD). It employs a nonlinear principal component analysis procedure of categorical principal component analysis (CATPCA). From the CATPCA output, five components considered to be key food value chain governance determinants affecting the export oriented horticultural value chain in Kenya were extracted and named as standards & certification, nature of transactions, level of chain integration, nature of contract and relational characteristics. The current research shows that with prioritisation of requisite food safety standards & certification schemes and discernment of transactional demands of heterogeneous export markets, horticultural exporters may expect to be competitive by means of improved product differentiation, process flows, logistical advantage and promotion of marketing & organisation management innovativeness. The implication therefore to the chain managers that standards & certification schemes are taking a critical position in determining food value chain governance especially through remote governance or governance from a distance other than the governance structure continuum of markets and hierarchies previously defined by transactional cost economics.

*Keywords: Categorical Principal Component Analysis (CATPCA), nonlinear principal components analysis, governance structures, standards, Fresh fruits & Vegetables, Kenya*

## 1 Introduction

Prior to global value chains (GVC) literature was the Global Commodity Chains literature. The underlying theme of governance in GCCs as previous developed by Gereffi (1994), relates to governance as a driver where much of the attention was in line with the trade-off between producer driven versus buyer driven governance forms (Dolan, Humphrey, & Harris-Pascal, 1999). Value chain nuance was later adopted to briefly broaden the understanding of how producers at upstream nodes of production are linked with their end markets, including manufacturers/retailers at downstream nodes. The dimensions providing this linkage as elaborated by Gereffi, (1994); Humphrey and Schmitz, (2002) is based on four different dimensions: 1) *Input-output structures* as forms of co-operation within a value chain for the manufacturing or processing a product; 2) *spatial patterns* which demonstrate the various value chain activities dispersed in the various regions or countries; 3) *Institutional framework* dimension that relates

to the regulations affecting the interaction of the value creation at the national or international level and 4) *governance structure(s)* which are largely concerned with the distribution of financial, material, and human resources within a value chain and their influence on the interaction and co-operation of the firm or actors in the chain. While the former three dimension remain largely descriptive, the latter dimension on governance stands out as a dimension that has generated the largest GVC discourse.

Value chain governance concept has been promoted as consequence of the emergent new approaches to supply chain management largely based on allocation of resources to core competencies and an increased trend towards outsourcing and sub-contracting of non-core functions; other approaches to adoption of GVC governance resonates with support of actors in the chain, setting of rules, the monitoring of compliance to the rules and punishment for violation of the rules (Kaplinsky & Morris, 2000). This trend has resulted to a general loss of control over the stages of production and distribution process especially to geographically dispersed regions. Vurro, Angeloantonio and Francesco, (2009) explain the rationale of broadening the concept of value chain governance from inter-firm relationships to global *fora*; this is due to the coincidence of falling regulatory barriers to international trade, advances in communication technologies and declining transportation costs. GVC scholarship has therefore continued to explore how changes in the organisation and coordination of global trade and production characterised in part by the splitting up of production processes between countries (Keane, 2012); and the promotion of functional integration especially in the areas of comparative advantage promoted through the lower entry barriers. Equally well, the mere entry into such value chains offers a huge potential for upgrading (Dallas, 2015) especially in form of knowledge sharing between the global North and global South. Other than these benefits, production outsourcing has posed challenges in relation to the integration complexities in the context in which international production and trade portends.

While, GVC literature has had Global Commodity Chains (GCCs) literature as its precursor; the underlying theme of governance in GCCs as previous developed by Gereffi (1994), has garnered much attention in line with the trade-off between producer driven versus buyer driven governance forms (Dolan, Humphrey, and Harris-Pascal, 1999) in promotion of value adding activities and processes along the supply chain of a given product from its raw state up to its completion and immediate sale before consumption. The value chain nuance in GVC literature broaden the understanding of how producers as upstream agents of production are linked with their end markets, including retailers as the downstream agents.

GVC studies have therefore continued to explore how changes in organisations and coordination of global trade and production characterised by the fragmentation of production processes between countries (Keane, 2012) has taken form as well as impacted the general international political economy. To Dallas, (2015) amongst other GVC scholars the effect of fragmented production has attracted keen interest in underscoring the opportunities and limitations engendered by the integration of the developing and the developed economies in the global North-South relations; other than the coordination of the global chains, conceptualization and measurement of 'value' and value appropriation has been endeared (Hammervoll, 2009, 2011) especially flowing from the borderless production systems and the effects of factors of production in promoting functional, products and social upgrading.

This paper seeks to ascertain the determinants of inter-firm governance as proposed in literature by Gereffi, Humphrey and Sturgeon (2005) on complexity of transactions, codification of transactions and supply base capabilities. The determinant on complexity of transaction is rearticulated as nature of transactions; codification of standards have been redefined under the codifications found in standards and certifications (Baars et al., 2016; Hatanaka et al., 2006; Hatanaka et al., 2005; Henson & Humphrey, 2010; Konefal, Mascarenhas, & Hatanaka, 2005; Ponte & Gibbon, 2005; von Hagen & Alvarez, 2011); supply bases capabilities are elaborated under the lenses of nature of contract(s) between the GVC chain actors (Ghosh & John, 1999, 2005; Gyau & Spiller, 2008; Ji, Felipe, Briz, & Trienekens, 2012; Madhok, 1996, 2005) and their level of chain integration (Flynn, Huo, & Zhao, 2010; Frohlich & Westbrook, 2001; Maleki & Cruz-machado, 2013; Moharana, Murty, Senapati, & Khuntia, 2012) as found relevant to agricultural value chains in developing economies (Dolan, 2004; Kherallah & Kirsten, 2002; Kirsten & Sartorius, 2002; Ochieng, 2007; Vlachos, 2014).

The assessment in this paper is based on Kenya's horticultural sector specifically the fresh fruits and vegetables' exports (forthwith referred to as FFV); the sector traces its transition of governance from spot markets in the 1960s to hybrid forms of governance from the 1990s onwards. While previous research into the Kenyan horticultural value chains conducted Dolan and Humphrey, (2000) sought to answer to the actors that defined what the chain requires, and how their requirements were transmitted to the various actors in the chain, this research sought to establish whether the GVC determinants specified by Gereffi *et al* (2005) are plausible with entry of European supermarkets chains in the 1990s in the niche markets for fresh fruits and vegetables (FFV) which changed the entire scope of food value chain governance's activities, decisions and their implications (Hernández & Pedersen, 2017).

Further to the trajectory that GVC scholarship research has taken, this paper notes two shortcomings have been levelled against it, namely; first, the basis from which value appropriation is identified on the various forms of governance under which firms/ chain actors operate in order to achieve value creation (Ghosh & John, 2005; Hammervoll, 2009, 2011); and second, the dependence of GVC insights largely being based on in-depth case studies as cited in the cases relating to garments (Gereffi, 1999), footwear (Schmitz, 1999), electronics (Sturgeon, 2002) and horticulture (Dolan & Humphrey, 2000) and thus the need for empirical testing (Dallas, 2015; Gellynck & Molnár, 2009; Ghosh & John, 2005; Hammervoll, 2011) for corroboration of the case study method. To overcome the latter shortcoming, this paper utilises survey data from 83 export oriented horticultural firms to assess the various governance determinants affecting the horticultural value chains.

The following sections of the paper are structured as follows. Firstly, the theoretical background on global value chains and application of conventional theory is discussed. Secondly, literature review on the global value chain governance determinants are discussed together with the formation of hypotheses. Thirdly, methodology in elaborated and findings with their discussions are fourthly offered; lastly, the paper offers conclusion.

## 2 Theoretical Precepts to Global Value Chain Governance

Exposition on value chain governance resides on the conceptual understanding of governance structures and the different governance typologies that are manifested. Going by Ebers & Oerlemans, (2013) definition, a governance structure is understood as a mechanism that coordinates and controls economic transactions; these mechanisms include administration of decision-making procedures, adjudication of residual rights of control, contractual agreements, pricing monitoring, formal rules and regulations, and procedures for negotiations, conflict resolution (p.7).

Governance typologies on the other hand were scaled up by Gereffi's seminal work (1994,1999) following Williamson's research on governance as viewed from extremes of market or hierarchies; these typologies were largely viewed as either being buyer driven versus producer driven forms of governance. Producer driven commodity chains being found in capital or labour resource intensive sectors; while buyer driven commodity chains, relating to retailers or markets providing the leading role in managing the supply chains.

The dichotomy of either buyer driven or producer driven commodity chains was further rearticulated by Gereffi, Humphrey and Sturgeon (2005) further with the range of inter-firms governance types due to the realisation of complexity of inter-firms relationships in the global economy. To them, "the key insight is that coordination and control of global scale production systems, despite their complexity, can be achieved without direct ownership" (Gereffi, *et al.* 2005, 81). The view of governance as coordination, emphasizes global value chains compared to the view of governance as driver that is based on the prior understanding of commodities and hence global commodity chains. This nuance points to the value addition dimension of the coordination.

The germane precepts of value added chains being traced to Kogut (1984) as per the definition of value added chain being the process by which technology is combined with material and labour input resources to achieve desired outputs, A single firm may consist of only one link in this process, or it may be extensively vertically integrated (Kogut, 1984) As such, the typologies by Gereffi *et al.* (2005) include governance value chain structures by market relations, modular value chains, relational value chains, captive value chains and hierarchical value chains. Significant to these governance structures are the determinants related to complexity of transactions, ability to codify transactions, capability of the supply base and degree of coordination and power asymmetry (Gereffi, Humphrey, and Sturgeon, 2005; Gibbon, Bair, and Ponte, 2008).

This research adopts Gereffi *et al.* (2005) and Gibbon *et al.* (2008) determinants by assessing complexity of transactions and ability to codify transactions as elaborated in nature of transaction and standards & certifications respectively; while the degree of explicit coordination and capability of supply-base are elaborated under the determinants of nature of contract and supply chain integration respectively, coordination & control; the degree of explicit coordination and power asymmetry is assessed under the nature of contract determinant.

### **3 Literature review and Hypotheses Development**

#### **3.1 Nature of Transaction**

Nature of a transaction is largely characterised by frequency, complexity and cost of a given transaction and the ability to codify the said transaction (Gereffi *et al.* 2005). Frequency of transaction is related to the number of repetitions of a transaction in a given period of time. Changes in transaction characteristics determine the variation of transaction costs, such as information, negotiation, and monitoring costs (Banterle and Stranieri, 2013); higher frequency of transactions brings familiarity to contracting parties with the exchanges in which human actors in charge of operations interact with one another; this more often, builds personal trust in relationships. As the level of trust increases, personal integrity may suppress opportunism and then reduce the degree of uncertainty. Agri-food supply chains continually improve due to stronger supply chain capabilities associated with increased coordination, information exchange, and responsiveness of the organizations involved, however, in globalised supply chains, the need for formal contracts cannot be downplayed especially due the rise of uncertainties, complexity of transactions and cost of transaction.

Complexity of transactions in this research follows from contribution by transaction cost economics (TCE) theory that adduces the effect that reducing complexity in transactions is sought after with the aim of seeking efficient governance structures as well as clarifying capability roles of various actors in the value chain; this complements the inadequacies cited with incompleteness of contracts especially in uncertainties and opportunism (Williams, Maull, and Ellis, 2002). Specifically, an efficient supply chain architecture is one that reduces transaction costs while affirming that complexity in production chains is strongly determined by product and process characteristics and spatial complexities between the raw material suppliers to end customers.

#### **3.2 Nature of Contract**

Nature of contract is also construed to be related to aspects of rights and obligations of the contracting parties. Some forms of contracts largely involved in the agro-sector include marketing contracts, production contracts and contract farming. As such, marketing contracts represent an agreement by a buyer to provide a market for the seller's output; in this arrangement, the seller transfers some risks and decision over when and how the product is to be sold to the buyer. Production contract on the other hand exists where the buyer supplies and manages all the inputs on the farm and the farmer usually becomes simply a supplier of the land and labour. Next in the supply chain continuum, there is the contract farming which refers to the system of production and supply of products by farmers to the buyers under forward contracts (Gyau and Spiller, 2008). Contracts as such are governance mechanism designed to attain two main objectives: first, to delineate authority and responsibility structure; and two, to share risk among chain partners (Ghosh and Fedorowicz, 2008; Vlachos, 2014).

Despite limitations associated with uncertainty, parties continue to contract to safeguard their interests as related to ownership rights. Ownership rights rationalised in economic sense to mean property rights; the rights offer most effective mechanism for providing economic agents with appropriate incentives to create, maintain, and improve assets (Chaddad and Iliopoulos, 2013; Chaddad and Cook, 2004). To Madhok (2005), ownership centred approach allows for control, which in turn allows flexibility over decision-making and adaptability.

The analysis of the formal allocation of ownership rights accordingly identifies three generic governance models as related to the extent to which members engage in decision management and decision control functions (Chaddad and Iliopoulos, 2013); these models include integration model, separation model, and delegation model; respectively represent from the highest to the least degree of decision making and control.

#### **3.3 Level of Chain Integration**

Supply chain integration (SCI) relates to the degree in which a focal/lead firm strategically collaborates and manages its intra and inter-organization processes with its supply chain partners (Flynn, Huo, and Zhao, 2010). The eventual goal of SCI is to achieve effective and efficient flows of products and services, information, money and decisions, in order to provide maximum value to the end customer (Frohlich & Westbrook, 2001).

Levels of chain integration have been elaborated in various varied ways by scholars; to some they consist of internal integration and external integration (Maleki and Cruz-machado, 2013; Tomas, Rosales, Batalha, and Alcantara, 2014); to others they includes product integration and process integration (Huo, Qi, Wang,

and Zhao, 2014) yet other scholars have within external integration alluded to both supplier and customer integration (Tomas *et al.* 2014). This paper focuses on the level of integration from the view of internal integration-to include both product and process integration from the internal operation of exporters (Helmi, Hua, and Mohd, 2013), and external integration to include the linkages of the exporters' upstream suppliers and downstream customers through customer integration (Boon-itt and Wong, 2011).

Level of chain integration is required internally within and across functions and externally across suppliers and customers (Boon-itt and Wong, 2011). Internal integration is characterized by full systems visibility across functions such as procurement, production, logistics, marketing, sales, and distribution; it is a key driver of competitive advantage in supply chain management (Van Hoek and Mitchell, 2006). The goal of internal integration is to develop a process-oriented focus; a focus on coordination across functional areas (Richey, Roath, Whipple, and Fawcett, 2010). External integration involves the effective alignment, information sharing, and participation in the interactions between firms their suppliers and customers. Supplier integration promotes collaboration by means of joint efforts in product development, problem solving, technology exchange among others (Moharana, Murty, Senapati, and Khuntia, 2012). On the demand side of a supply chain, firms discern into the customer organization(s) to understand their product, culture, market and organization in such a way that they can respond rapidly to the customers' needs and requirements.

Agri-food supply chains continually improve due to stronger supply chain capabilities associated with increased coordination, information exchange, and responsiveness of the organizations involved. The degree of coordination is largely affected by factors related to changing consumer preferences, increased need for information management, advancement in biotechnology and environmental concerns; due to these factors there is increased movement from spot market type of governance to more closely coordinated forms of governance focusing on relational or vertically coordinated forms of governance. Therefore the level of coordination can be related to a particular form of governance where the levels of risks and returns associated; consequently, the level of chain integration aims at promoting interdependency, structures or formative relationships which are communicative through exchange of information, collaborative alignment, profitability and competitive advantage (Engelseth, 2009).

### 3.4 Standards and Certifications

Discourse on standards and certifications have largely been fronted as either a remote governance instrument or a differentiation determinant to in speciality marketing. With the governance view, Abbott and Snidal, (2001) first point out that standards and certification schemes are applied to deal with externalities and are sub-categories of governance, to these authors, "externality occurs whenever one actor's conduct affects the well-being of another"(347). Secondly, adoption of standards have given rise to remote forms of governance by way of defining and managing value chain specific activities, setting conditions of participation in value chains, determining functional division of labour and barriers to entry along the chain (Nadvi, 2008; Ponte & Gibbon, 2005). Finally, as proposed by Ponte and Gibbon (2005), standards have become conventions to regularise by way of promoting or sanctioning functions, actors and their activities have thus impacted on the management and administrative mechanisms of value chains and their structures as well as availed upgrading opportunities for producers or appealed means for sustainability (Ponte & Cheyins, 2013). The rise of food standards in export value chains and the demand for consistent high volumes and good quality produce has led to more vertically integrated value chains (von Hagen & Alvarez, 2011); this view is corroborated by both Vlachos', (2014) four categorisation of supply chain governance typologies namely spot markets, standards, contracts and vertical integration.

The differentiation view of standards and certifications has largely been witnessed by adoption of standards as an competitive incentivising tool to fresh produce importers (García Martínez & Poole, 2004; Garcia Martinez, Poole, Skinner, Illés, & Lehota, 2006); Reardon, Codron, Busch, Bingen, and Harris (1999) augment these views by the assertion that: "the role of grades and standards (G&S) has shifted from a technical instrument to reduce transactions costs in homogenous commodity markets to a strategic instrument of competition in differentiated markets. The nature of G&S has shifted from performance... to process standards" (p. 421); to these authors three strategic responses to grades and standards have been applied by various agencies, namely: (i) by large private certification, labelling and branding systems; (ii) by medium-large domestic firms, to lobby governments to adopt public G&S similar to those in export markets in developed regions; (iii) by small firms to ally with public and non-profit sectors to form G&S and certification systems to all export markets.

Other than the two general frontiers that the discourse on standards has taken, standards and certifications have been differentiated into two strands in the horticultural export sector namely; public standards formed by regulations imposed on imports; such regulations fall under the World Trade

Organization (WTO) rules. These regulations are subject to the Agreements on Sanitary and Phyto-Sanitary barriers (SPS) and Technical Barriers to Trade (TBT). The second set of standards are composed by standards emerging from retailers' action and are required by several large multinational retailers, some wholesalers and food service companies such as GlobalGAP, formerly EureGAP; these type of standards are described as voluntary or private standards; the depth into this duality of public and private standards has been exhaustively done in Busch's works (Busch, 2009, 2010, 2011, 2014; Busch et al., 2005).

With the entry of European supermarkets in the Fresh Fruits and Vegetable (FFV) supply chain saw the proliferation of standards and stringent conditions being required of the upstream agents and exporters for reasons related to due diligence as instigated by UK's Food Safety Act 1990 thereafter the emergence of EureGAP; spawning from the public regulations a myriad of standards and certification schemes are currently in place. Proliferation of standards necessarily brought about further changes in FFV chain governance with a huge attrition of non-compliant smallholders farmers (Dolan and Humphrey, 2000). The underlying motive of the standards and certification schemes is discussed to have both an assurance cum compliance objective to State agents amongst other stakeholders as well as promoting competitive advantage by way of introducing entry barriers in the speciality markets (Konefal et al., 2005; Ouma, 2010) or promoting certain credence attributes in products such as organic, natural and socially friendly attributes.

This paper adopts an eclectic view to standards and certification discourse of having the standards and certification as a determinant as the premise to which remote governance is achieved. As such in adopting the approach by Ponte and Gibbon, (2005) of convention theory's application in quality standards in the role of defining and managing value chain specific activities, the determinant of standards and certifications is applied in this research to assess its efficacy in promoting competitiveness in horticultural value chains especially as a consequence of promoting food quality and safety (Martino and Perugini, 2006).

### **3.5 Competitive Advantage Concept**

Porter's (1985) value chain concept is considered a crucial tool for analysing the sources of competitive advantage; competitive advantage being understood as the degree in which a firm reduces its cost, exploits opportunities and neutralizes threats (Newbert, 2008). Value chain analysis comprises disaggregation of the firm into its strategically relevant activities in order to understand the behaviour of costs and the existing and potential sources of differentiation (Bhatnagar & Teo, 2009). Accordingly, by optimising and coordination of linkages associated with the aligned value chain actors, firms' competitive advantage can be gained as a net benefit to the members.

Optimisation and coordination alignment criterion is discerned to be aligned to capabilities that either centred to the value chain actors or to capabilities that are customer centered; specific capabilities that are specified to members of a given value chain are said to be based on resources that are viewed in their unique or inimitable capability (Zajac & Olsen, 1993); some of these capabilities that promote inter-organizational competitive advantage are identified by Dyer and Singh (1998: 232) to constitute the following: (1) relations specific assets; (2) knowledge-sharing routines; (3) complementary resources and capabilities; and (4) effective governance. Competitive capabilities that are customer oriented as elaborated by Li, Ragu-Nathan, Ragu-Nathan, and Subba Rao, (2006) consist of competitive pricing, value to consumer quality, dependable delivery, and production innovation. In line with these capabilities, especially the customer focussed; Kenya's FFV sector as Dolan and Humphrey (2000) emphasizes has been concentrated on capabilities and strategies of quality, consistency, variety of the products, processing levels, product combinations, packaging, reliability of supply and price; other capabilities that have been cited of the sector include quality, delivery dependability, product innovation and time to market. It's notable however that Kenya has had uncompetitive airfreight rates compared to other African countries such as Egypt and Morocco for bulk produce (Dolan and Humphrey, 2000); the sector has been witnessed to rely more on a differentiation strategy other than cost based advantage.

In toto, the aforementioned determinants under nature of transactions, standards and certifications, level of chain integration and nature of contracts are related to the dependent variable of competitive advantage through differentiation based strategies. Based on governance value analysis, adoption of a given governance structures is a deliberate business strategy adopted by the chain actors through a conscious and deliberate decision making process (Soares, Dorneles, & Pereira, 2010; Ghosh & John, 1999) that is largely a cost or differentiation option on whether to adopt a market structures, intermediate or hierarchical type of governance. To Gold, Seuring, and Beske, (2010), effective governance promotes competitive advantage by promoting value-creative initiatives, this is partly met through the transactors' choice of governance structure(s) that minimizes transaction costs, thereby enhancing efficiency.

### 3.6 GVC Determinants-Competitive Advantage Hypotheses

The earlier discussion provided support for governance value chain determinants and their contribution to promotion of competitive advantage. The current research tests this proposal by examining the relationship between the selected GVC determinants and competitive advantage in terms of product differentiation, process flexibility, logistics advantage and marketing & Management innovation. The hypotheses (H1 through H4) for the four competitive strategies follow:

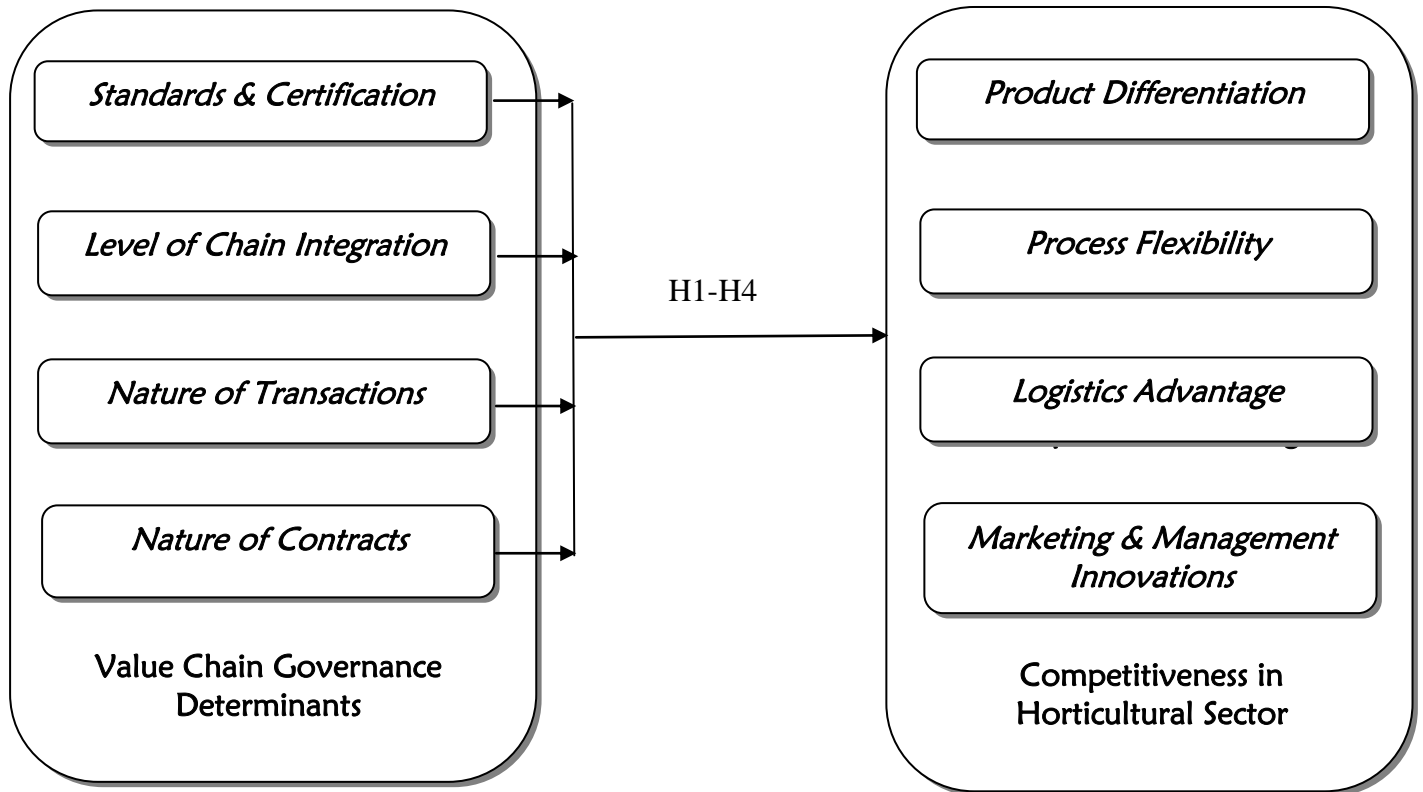
- H1:* Standards and certifications is positively related to Kenya's horticultural value chains competitive advantage:
  - H1a.* product differentiation;
  - H1b.* process flexibility;
  - H1c.* logistics advantage; and
  - H1d.* marketing & management innovation.
  
- H2:* Level of chain integration is positively related to Kenya's horticultural value chains competitive advantage:
  - H2a.* product differentiation;
  - H2b.* process flexibility;
  - H2c.* logistics advantage; and
  - H2d.* marketing & management innovation.
  
- H3:* Nature of transaction is positively related to Kenya's horticultural value chains competitive advantage:
  - H3a.* product differentiation;
  - H3b.* process flexibility;
  - H3c.* logistics advantage; and
  - H3d.* marketing & management innovation.
  
- H4:* Nature of contract is positively related to Kenya's horticultural value chains competitive advantage:
  - H4a.* product differentiation;
  - H4b.* process flexibility;
  - H4c.* logistics advantage; and
  - H4d.* marketing & management innovation.

Figure 1 presents the conceptual model with hypotheses.

## 4 Methodology

A general review of the GVC literature provided the foundation of this study. A cross section survey was conducted to collect data that was used to test hypotheses. A census survey was adopted due to the small proportion of the population of one hundred and twenty exporter firms in the horticultural export sector; this was opted for in line to Israel, (1992) recommendation whereby, census is appropriate for two hundred or less units since it eliminates sampling error and provides data on all individuals in the population with precision and accuracy; however Bartlett, Kotrlik, and Higgins, (2001); Krejcie and Morgan, (1970) propose samples for fewer populations. The study was conducted in between the months of November 2015 and January, 2016; the accessible population were either the owners of the exporting companies, their agronomists, quality assurance officers, or pack-house managers/supervisors. A semi-structured questionnaire was used. Both the study and targeted population consisted of a 83 respondents representing 69 percent of the 120 exporters registered with both fresh produce exporters association of Kenya (FPEAK) and Horticultural Crops Directorate (HCD) in Kenya.

Data was analysed using SPSS version 24 with the categorical principal component analysis (CATPCA) reduction feature also known as nonlinear principal component analysis (PCA) (Linting and van der Kooij, 2012; Meulman, Van der Kooij, and Heiser, 2004) owing to the categorical nature of the variables under the research study. The use of CATPCA was aimed at reducing the observed variables to a number of uncorrelated principal components which are explained as the key components associated to food value chain governance determinants on the competitiveness of Kenya's horticultural exports.



**Figure 1.** Conceptual Framework

Categorical principal component analysis (CATPCA) was adopted to principal component analysis (PCA) method; the latter is largely meant to reduce the number of given variables to a smaller number of uncorrelated variables called principal components which account for the variance in the data as much as possible. While PCA is suitable for continuous variables which are scaled at the numerical level of measurement such that interval or ratio it also assumes linear relationship among variables, it is thus not an appropriate method of dimension reduction for categorical variables (Kemalbay and Korkmazoğlu, 2014).

CATPCA thus presented several advantages over standard PCA. First, CATPCA allows incorporating nominal and ordinal variables; second, it does not assume that the relationships between variables are linear, and can therefore handle nonlinear relationships between variables (Claveria and Poluzzi, 2016). This is explained by the nature of categorical variables whereby unlike numerical variables, they are described by indicators with a limited number of categories. The zero in binary variable scales is uncertain, the relationship among the different categories is also unknown, and although some of the variables are composed of categories that are ordered, their mutual distances are as well unknown; so the method of CATPCA is thus adapted (Antonelli and Taurino, 2009). Third, CATPCA can also handle well small data (Odekerken-Schröder, Hennig-Thurau, and Knaevelsrud, 2010).

## 5 Factor Analysis, Statistical Analysis and Results

There were 120 fresh fruits and vegetable exporter firms targeted from whom 83 responded to the survey, a response rate of 69 percent was achieved. The sector demographics indicated that, ownership of the exporter firms relate to sole proprietorship, partnership and limited liability companies, these were respectively represented in percentages of 8.4, 7.2 and 84.3. The age of the exporter firms represented in percentage and categorised in the range of firms below 5 years, 6-10 years, 11-19 years and 20 years and above was 31.6, 25.0, 26.3 and 17.1 respectively. Majority of the exporters representing 66.3 percent were involved with exports of both fruits and vegetables while exporters who dealt exclusively with vegetables and fruits represented 21.7 and 7.2 percent respectively; 4.1 percent of the exporters exclusively dealt in processing of both or either fruits and vegetables. Export destinations for Kenyan fresh fruits and vegetables is largely dominated by Europe Union, specifically to United Kingdom, Netherlands, France, Germany and Sweden other regional destinations include Middle East and Eastern



and South Africa.

Two phases of CATPCA analysis were carried out; The first phase for the analysis was to assess significant indicators elaborating on the individual variables of nature of contract, standards and certifications, supply chain integration and nature of transactions; the second phase entailed a joint CATPCA for all the factors that with significant loading to all variables for the purpose of further analysis of their effect to competitive advantage of Kenya's horticultural export sector.

Initial CATPCA phase was carried out independently to the four supply chain governance variables namely nature of transactions, nature of contract, standards & certification and supply chain integration in order to ascertain the indicators with factor loading of 0.4 and above; indicators with factor loading of 0.4 and above were therefore retained for the purpose of the joint CATPCA analysis. First, under the variable of nature of transactions the following eight indicators were selected; type business ownership (0.720); countries of export categorized (0.675); frequency of export (-0.423); outsourced factors production, processing & logistics (-0.613); exclusive agreements with importers (0.699); direct orders from European retail (-0.591); selling through middle merchants (0.599); use of export processing village (0.563). The second variable of standards & certification had the following six indicators, namely: good agricultural practices (gap) in place (1.143); gaps audits conducted (1.143); categories of standards place (-0.753); documented procedure for recall (0.696); conducted mock recall (0.771); products guarantee to importers, retailers or ultimate consumers (0.752).

Thirdly, the variable under nature of contract garnered ten indicators which included the following type of contract arrangements: import oral contract (-0.420); import sales contract (-0.540); import production & sales contract (0.590); supplier oral contract (0.414); supplier sales contract (0.571); supplier production & sales contract (0.585); brokers engagement (0.643); engage brokers in oral contract (0.512); engage brokers in sales contract (0.651); engage brokers in production & sales contract (0.627). Finally, the fourth variable under value chain integration had the following sixteen indicators that had a Cronbach's alpha of 0.4 and above, these indicators included responses by exporters the following statements: strong internal information sharing (0.518); joint management decisions (0.783); frequent interdepartmental meetings (0.801); open door policy (0.636); close supplier contact (0.802); constant customer feedback with our suppliers (0.924); sharing of production forecast with customers (0.802); involvement of supplier in quality inspection (0.782); establishment of close customer contact (0.802); involvement of suppliers in quality inspection (0.782); joint decision making between suppliers & customers (0.983); collaboration with regulators (0.439); emphasis on supplier-customer openness (0.985); promotion of strong corporate relations (0.793); ensuring quality monitoring (0.987) and coordinate in quality control issues (0.598).

The selected indicators representative of the four supply chain governance determinants were in the second phase subjected to a joint CATPCA analysis in order to ascertain that they were uncorrelated. Table 1 summarises the output of the results and their loadings. The result of the output loadings realised five dimensions; specific to each dimension, factor loadings of 0.4 and above were retained for the purposes of running regressions. Apart from the factor loadings criterion, Kaiser criterion of retaining only dimensions with eigenvalues greater or equivalent to 1 was used; in essence Kaiser criterion elaborates that a factor explains at least as much variance as the equivalent of one variable, otherwise it should be left out (Antonelli and Taurino, 2009). Summary of the dimensions is given as follows.

Indicators under dimension 1 that had a loading of 0.4 and above constituted the following, namely; good agricultural practices (GAP) in place (0.959); good agricultural practices (GAP) documented (0.959); gaps audits regularly conducted (0.959); we promote interdepartmental meetings with our different departments & units (0.959) and we have an 'open door' policy to our stakeholders (0.731); feedback to suppliers shared (0.844); supplier involvement in quality inspection (0.958) and quality control coordination (0.456). Upon review of the indicators listed, dimension 1 was relabeled as *standards and certifications* in line with the with involvement of the horticultural exporters in strict GAP practices; suppliers involvement in quality as well as quality coordination being highly appraised under consultative decision making processes that are paramount in sustaining quality standards along the value chain.

Dimension 2 tapped on the following statements, namely; we promote internal information sharing (0.595); we have close supplier contact (0.924); we share feedback from importers to our suppliers (0.844); we share our supplier forecast with customers (0.925); we establish close customer contact (0.925) and brokers are part of downstream actors. This dimension was relabeled as *level of chain integration*. This dimension was related to integration largely due to the link between close supplier and customer contacts shared through joint forecasting, synergized communication, quality monitoring and enhanced openness and corporate relations.

Dimension 3 constituted of four indicators; namely, decision making is communicated to our suppliers & customers (0.966); we emphasis openness (0.965); we have strong corporate relations (0.764) and we

have quality monitoring in our systems (0.966). Dimension 3 was relabeled as *relational characteristics* with emphasis being relational aspects centered on communication between suppliers and customers, strong corporate relations guided by openness and promotion of quality monitoring systems and processes.

Dimension 4 constituted of eleven indicators, namely type of business ownership (-0.480); countries of exports categories (-0.550); direct orders from European retailers (0.503); codification of standards (-0.587); exporters engagement with importers through sales contracts (-0.409); Production & Sales contracts (0.450) and importers forming part of the upstream actors through ownership of part of production (0.468); exporters engagement with suppliers through sales contracts (-0.442) and production & Sales contracts (-0.551); brokers engagement (-0.405) is firm up through brokers' oral contracts (-0.524) or production & sales contracts (-0.456). Dimension 4 was relabeled as *nature of transactions* relating to the way horticultural exporting is conducted to destination countries; to some countries export demand such as in EU regulation are considered homogenous export demands especially in food safety standard requirements; other destinations may require varied conditions to be met and hence being described as having heterogeneous export demands. Respectively, exporters working with the latter type of demands would be required to have their upstream and downstream actors commensurately aligned in response to these unique transactions.

This dimension also related strongly with the preference by importers being integrated upstream with production for enforcement of certain requisite demands or engaging in production and sales type of contracts; other contract types that are witnessed under this dimension although the indicators are negative in sign include engagement of sales contracts by importers and suppliers as well as the involvement of brokers through oral, or production & sales types of contracts. The plausible view for support of oral contracts as well as engagement of brokers by many exporters can be related to external contingencies; these contingencies may be due to two factors namely, the short product life cycle of fresh fruits and vegetable exports and contingency reasons. It makes it easier for exporters to work with brokers with the sector's experience as a reliable alternative especially in filling in demand short falls of the ordered quantities that may not be well forecasted or for cost reasons related to buffer inventory carrying costs.

Dimension 5 constituted of contract related indicators to frequency of exports to importers (0.408); various forms of contracting suppliers or brokers for various factors of production. These forms of contracts loaded as follows; exporters engagement with importers through sales contract (-0.418); production & sales contracts (0.559); exporters engagement with suppliers through production & Sales contracts (0.524); exporters engagement with brokers was confirmed (0.618); through oral contracts (0.568); sales contracts (0.629) and through production & sales contracts (0.654). Dimension 5 was relabeled as *nature of contracts* largely due to two conditions related to frequency of exports and the general framework related to the various contract forms adopted. Depending on the level of engagement and collaborations, contracts are in this sector operationalized as oral contracts to largely trust driven firms and either production & sales or sales contracts to adversarial or short term transactions type of engagements. While the recourse to brokers engagement is evident, their role is largely considered adversarial and mostly relied upon for contingency and short-term; on the other hand while exigency reasons for engaging brokers hold true, exporters stand the risk of losing key customer accounts due to reliance of brokers especially if products are compromised.

Overall as per table 1, the five dimensional CATPCA components/dimensions were interpreted in this study as standards & certifications, level of chain integration, relational characteristics, nature of transactions and nature of contracts. The extracted dimensions realized eigenvalues greater than one with sufficient reliability; the total Cronbach alpha for all the dimensions was 0.987 with a total eigenvalue of 22.850; each of the extracted dimensions had a Cronbach alpha of 0.895, 0.835, 0.768, 0.718 and 0.678 respectively with a variance accounted for by each of the dimensions being 7.515, 5.222, 3.911, 3.287 and 2.915 for each of the extracted dimensions respectively. The percentage variance accounted for by the five dimensions were 33, 23, 17, 14 and 13 respectively.

CATPCA analysis was also conducted to the dependent variable on competitive advantage; this was effected to the individual sub-variables linked to differentiation strategies of product differentiation, process flexibility, logistics advantage, and marketing & management innovation. Indicators with factor loading of 0.4 and above were therefore retained for each of the sub-variables for the purpose of regression analysis with the defined GVC determinants. A single component defining each of the sub-variables was obtained from the CATPCA.

The loading of the indicators respective to each of the sub-variables is specified; first, under the sub-variable of product differentiation the following nine indicators were selected; process assurance in

products (0.425); natural and socially produced products (0.575); convenient and ready to eat products (0.722); new product varieties (0.624); juices and drinks (0.619); ready to eat snack (0.736); products with sensory characteristics of unique taste (0.688), texture & color appeal (0.508) and product mixes (0.616). The second sub-variable on process flexibility had the following five indicators, namely: rapid product change (0.655); ease of adjustment to production volumes (0.706); ease of handling product mixes (0.643); ability to customize orders fast (0.690), and promptness in handling complains (0.751). Thirdly, the sub-variable of logistical advantage under competitive advantage garnered five indicators which included securing sufficient air cargo volumes (0.809); seamless logistics flows (0.650); accuracy to locate dispatched products (0.683); presence of reverse logistics/product recall plans (0.551) and availability of specialized/cold chain transport (0.825). Lastly, the fourth sub-variable on marketing and management organization innovativeness under competitive advantage had the following 10 indicators that had a Cronbach's alpha of 0.4 and above, these indicators included; presence of marketing innovation (0.680); new marketing methods (0.752); new product designs (0.586); new packaging (0.787); new product placements (0.743); new product promotion (0.794); new product pricing (0.635); management organization innovation by: knowledge management (0.558), business practices (0.494) and external relations (0.529).

**Table 1.**  
CATPCA and Reliability on Joint Value Chain Governance Determinants

	Dimension				
	1	2	3	4	5
Business Ownership	-0.031	-0.391	-0.263	<b>-0.470</b>	0.077
Countries of Export Categorized	0.020	-0.321	0.008	<b>-0.550</b>	-0.391
Frequency of Export to Importers	0.049	0.051	0.055	0.311	<b>0.408</b>
Direct orders from European Retail (Mkt)	-0.041	0.098	0.347	<b>0.503</b>	-0.185
Good Agricultural Practices (QA)	<b>0.959</b>	-0.244	0.063	-0.027	0.074
Is the GAPs Documented (QA)	<b>0.959</b>	-0.244	0.063	-0.027	0.074
Gaps audits Conducted (QA)	<b>0.959</b>	-0.244	0.063	-0.027	0.074
Codification of Standards	-0.172	-0.087	-0.224	<b>-0.587</b>	-0.125
Internal information Sharing	0.124	<b>0.595</b>	-0.053	0.191	-0.128
Joint Management decisions	<b>0.959</b>	-0.244	0.062	-0.027	0.074
Interdepartmental Meetings	<b>0.960</b>	-0.241	0.062	-0.027	0.072
Open Door Policy	<b>0.731</b>	-0.157	0.034	0.041	0.183
Close Supplier Contact	0.226	<b>0.924</b>	-0.122	-0.218	-0.020
Feedback to Suppliers Shared	<b>0.844</b>	<b>0.485</b>	-0.043	-0.168	0.036
Customer Supplier Forecast	0.226	<b>0.925</b>	-0.121	-0.217	-0.020
Supplier involvement in quality inspection	<b>0.958</b>	-0.245	0.067	-0.018	0.075
Close Customer Contact	0.225	<b>0.925</b>	-0.122	-0.218	-0.013
Decision making done by suppliers & Customers	-0.044	0.089	<b>0.966</b>	-0.117	-0.082
Emphasis Openness	-0.042	0.098	<b>0.965</b>	-0.114	-0.087
Corporate Relations	-0.049	0.052	<b>0.764</b>	-0.157	-0.059
Quality Monitoring	-0.043	0.091	<b>0.966</b>	-0.116	-0.087
Quality Control Coordination	<b>0.456</b>	0.326	-0.060	0.239	-0.071
Import Sales Contracts	0.100	-0.008	0.028	<b>-0.409</b>	<b>-0.418</b>
Import Production & Sales Contracts	0.001	0.353	-0.005	<b>0.450</b>	<b>0.559</b>
Importer integrated upstream	-0.007	-0.320	-0.272	<b>0.468</b>	0.163
Supplier Sales Contract	0.128	-0.025	-0.209	<b>-0.442</b>	-0.331
Supplier Production & Sales Contracts	-0.033	0.352	0.244	0.310	<b>0.524</b>
Brokers engagement	-0.378	-0.246	0.087	<b>-0.405</b>	<b>0.618</b>
Broker engaged through Oral Contract	-0.026	-0.038	0.019	<b>-0.524</b>	<b>0.568</b>
Broker engaged through Sales Contract	-0.328	0.114	0.051	-0.397	<b>0.629</b>
Brokers engaged by Production & Sales Contract	-0.032	-0.057	0.066	<b>-0.456</b>	<b>0.654</b>
Broker part of with downstream Supplier	-0.225	<b>-0.921</b>	0.123	0.224	0.017
Dimension	Cronbach's Alpha	Total (Eigenvalue)	% Variance Accounted For		
1. Standards & Certification	0.895	7.515	33		
2. Level of Chain Integration	0.835	5.222	23		
3. Relational Characteristics	0.768	3.911	17		
4. Nature of Transactions	0.718	3.287	14		
5. Nature of Contracts	0.678	2.915	13		
Total	<b>0.987<sup>a</sup></b>	<b>22.850</b>	<b>100</b>		

a. Total Cronbach's Alpha is based on the total Eigenvalue.

Overall, the respective competitive advantage's sub-variables garnered the following Cronbach's alpha and eigen values; product differentiation (0.800; 3.456), process flexibility (0.728; 2.393), logistics advantage (0.756; 2.528) and marketing & management organisation by innovation (0.859; 4.411).

The combined effect of the GVC determinants to the respective competitive advantage's sub-variables of product differentiation, process flexibility, logistics advantage and marketing & management organisation by innovation were determined by multiple regression analysis.

The determinants considered as independent variables were standards and certifications, nature of transactions, value chain integration, relational characteristics and nature of contracts which were analysed to determine their effect to the dependent variable of competitive advantage under product differentiation, process flexibility, logistics advantage, and marketing & management innovation sub-variables. The regression results are presented in table 2.

The hypotheses were tested by using multiple regression analysis. First, each of the hypotheses H1 through H4 concerning the influence of standards on innovation; the outcomes were tested using multiple regression analysis. Each of the antecedent variables was first regressed on to each competitive advantage outcome in a standard linear expression ( $Y = b_0 + b_1 X$ ). Table 2 shows the results of the hypotheses testing. The left-hand portion of the table illustrates the direct effects of standards & certifications, nature of transactions, value chain integration, relational characteristics and nature of contract on the different competitive advantage related to the differentiation strategies tested.

**Table 2.**  
Results for Multiple Regressions

Direct Effect	Product Differentiation	Process Flexibility	Logistics Advantage	Marketing and Management Innovations
	$\beta$	$\beta$	$\beta$	$\beta$
<i>Standards &amp; Certification</i>	0.136	0.209**	0.775***	0.226**
<i>Level of Chain Integration</i>	-0.029	0.136	-0.184**	0.061
<i>Relational Characteristics</i>	0.065	0.191	-0.028	0.175
<i>Nature of Transactions</i>	0.320**	0.226**	0.014	0.181
<i>Nature of Contracts</i>	0.145	-0.021	0.123	0.318***
F	2.716	2.780	28.272	4.335
R <sup>2</sup>	0.150	0.153	0.647	0.220
Model Significance	0.026	0.023	0.001	0.002

Notes \* $p < 0.05$ ; \*\*\* $p < 0.001$ ;

The results indicate that Standards & certifications had a direct effect on process flexibility ( $\beta = 0.209$ ;  $p < 0.05$ ), logistics advantage ( $\beta = 0.775$ ;  $p < 0.001$ ) and marketing & management innovations product innovations ( $\beta = 0.226$ ;  $p < 0.05$ ). The level of chain integration has a negative effect to logistics advantage ( $\beta = -0.184$ ;  $p < 0.05$ ); there was no effect on relational characteristics to competitive advantage. Nature of transactions had a positive and direct effect on product differentiation ( $\beta = 0.320$ ;  $p < 0.05$ ). and process flexibility ( $\beta = 0.226$ ;  $p < 0.05$ ); lastly nature of contracts had a positive effect in the way that marketing and management organisation innovations ( $\beta = 0.318$ ;  $p < 0.001$ ) were aligned. Figure 2 details the seven direct relationships supporting the relationships supporting hypotheses H1b, H1c, H1d, H2c, H3a, H3b and H4d.

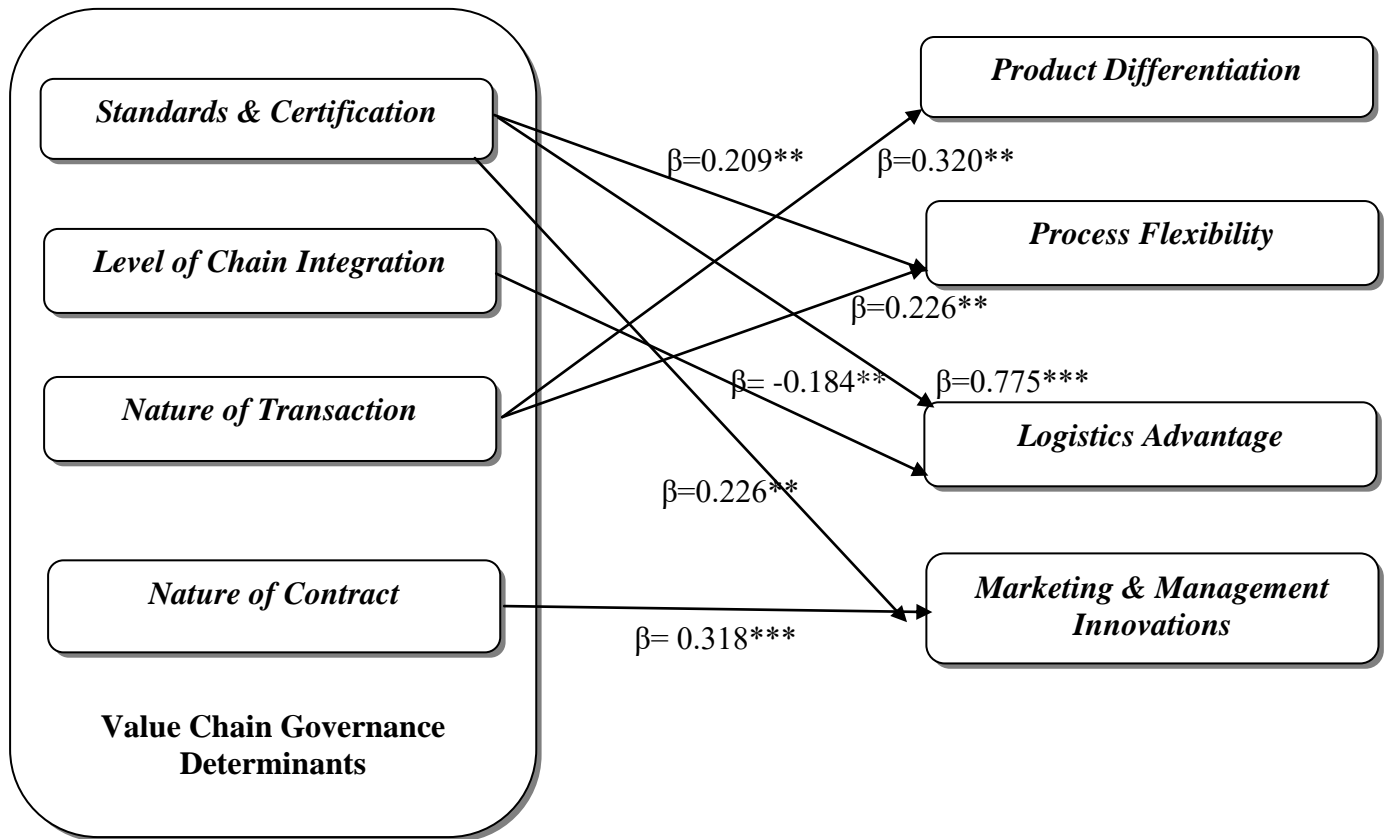


Figure 2. Examination of the Main Effects

## 6 Discussion and Conclusion

Today firms, agencies and stakeholders operating under the global value chain are to a large extent required to adjust to a particular GVC configuration of activities, decisions and their implications. The choice in any GVC configuration is set on the premises of governance, location and coordination of the specific chain activities; the implications for such a configuration are largely assessed on upgrading and performance measures. This demands are demanded as well by horticultural value chains to no exception. The strive for best alignment, strategic positioning and coordination to global value chains has continually been set against an assessment of governance related determinants on nature of transactions, ability to codify these transactions and assessment of the capabilities of the supply base at the firm, national, regional and international level; however, changes experienced to horticultural value chains especially pertaining to safety and standards mechanisms in the last two decades have warranted the reassessment of these determinants.

The re-assessment of the forestated determinants in this research and as guided by literature to seek the efficacy of standards and certifications, nature of transactions, level of supply chain integration, nature of contracts and relational characteristics as critical dimensions to export driven horticultural value chains. The study affirms and corroborates statistically the centrality of these determinants to the sector's competitive strategies -product differentiation, process flexibility, logistical advantage and innovations related to marketing and organisational management - to developing economies in their trade with developed economies. Novel to this research is critical role of standards and certifications as characteristic and strategic instrument of competitiveness through the promotion of process flows that have traceability principles in place, promotion of logistics advantage and innovative marketing and organisational management practices. Due to differentiated export markets demands the nature of transactions remains the key factor in promotion of horticultural GVCs especially in transactional costs analysis. The level of chain integration and nature of contracts have facilitated in logistics coordination and promotion of marketing & management organisation's innovations respectively. Overall, standards and certification schemes have a forceful impact on the management and administrative mechanisms of

value chains and their structures; as in the case of Kenya's horticultural export sector the said standards have availed upgrading opportunities for producers. The rise of food standards in export value chains and the demand for consistent high volumes and good quality produce has as well increased the need for contingency planning and increased corporate relations. As an emerging phenomena, horticultural sector producers are increasingly realigning the traditional GVC structures to currently favouring hybrid governance structures with greater flexibilities and expediency that is synchronised with the constraints related to short-product life cycle of fresh fruits and vegetable exports and changing customer demands.

### 6.1 Limitations

This study has several limitations that should be noted before generalizing the results to all firms. First, this study is cross sectional looking at essentially one industry (horticultural) and one period of time. Additionally, the timing of the study was meant to ensure as many firms would participate owing to the seasonality of the sector that renders some firms not be active throughout the year hence the possibility of adopting two periods of time would increase the number of firms that would participate. Finally, the setting of the survey instrument was largely dichotomous in nature and hence the adoption of CATPCA factor analysis, a similar research could be modelled in future studies to better understand other exploratory analysis in the sector that has applied in-depth and detailed case studies.

### 6.2 Implications for Future Research

The limitations of this study open up an extended research window in adoption of governance choices. First, supply chain and GVC researchers would extend this study to examine multiple industries. For example, one would expect the floriculture sector to experience different outcomes in terms of a specific governance choice. Multiple industry and country analysis should be employed to develop a better theoretical grounding of GVC governance choices.

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