Agri-food value chain transparency and firm performance: the role of institutional quality

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ABSTRACT
This paper investigates agri-food value chain transparency and the role of institutional quality on agri-food processing firms’ performance. The research collected primary data via survey to analyse 320 agri-food processing firms. This study empirically established that value chain transparency and institutional quality significantly improve agri-food processing firms’ performance. Also, institutional quality positively moderates the relationship between value chain transparency and the performance of agri-food processing firms significantly. The empirical results in this paper imply that stakeholders in the existing and incoming agri-food processing firms should prioritise transparency and institutional quality in making managerial decisions to achieve higher performance in their value chain. The study’s uniqueness is its contribution to value chain literature and also towards the development of the agri-food value chain sector to enhance performance in a developing economy.

1. Introduction
The shortfalls of emerging economies in producing quality and adequate essential goods at affordable prices to successfully penetrate standardised international markets have been well established (Naidoo & n.d.ikumana, 2020; Wickramasinghe & Wickramasinghe, 2017) and have been a top concern globally. Evidence of the ‘production shortfall’ can be traced to manufacturing firms’ meagre contributions to the emerging countries’ gross domestic products (GDP; World Bank, 2020). In Ghana, for instance, the manufacturing sector contributed a meagre 6.1 per cent to GDP in 2020 (Ghana Statistical Service [GSS], 2020). Due to the crucial relation of supply chain management to firms’ performance (Mentzer et al., 2001; Verhoef, 2003), several studies view a firm’s competitive strength as its products (quality/quantity) and its supply chain activities (Irland, 2017; Lee & Bateman, 2019; Miyare, 2014). Among these activities is value chain transparency. Although transparency in the value chain requires the disclosure of firms’ products’ origins, testing results, certifications, suppliers’ compliance with labour-practice norms in their annual reports, and sustainability reports concerning
product quality, safety, and legal requirements (Ahmed & Omar, 2019; Gardner et al., 2019; Greer & Purvis, 2016; Kraft et al., 2018; Sodhi & Tang, 2019; Trienekens et al., 2012; Wognum et al., 2011); it could be argued that consumers also reward firms that ensure transparency in their operations and punish those that do not. Transparency in value chains could lead to cost, quality, flexibility advantages, sustainability, and ethical differentiation to determine firms’ performance output (Bastian & Zentes, 2013; Heras-Saizarbitoria & Boiral, 2013; Llach et al., 2011). Yet, creating transparency in firms’ supply chains is an emerging business challenge for companies (Buell et al., 2017). Hence, for the performance of agri-food processing firms to improve, there is a need to maintain operational synchronisation by sharing an appropriate quantity and format (Han & Dong, 2015; Sarkis et al., 2011).

The relationship between firm performance and supply chain transparency has been studied in literature by several authors (Aggarwal & Jorion, 2012; Ahmed & Omar, 2019; Bastian & Zentes, 2013; Beulens et al., 2005). However, other studies argued that the benefits of supply chain transparency would depend on institutional quality because institutions set the rules and define modes of operation (Scott, 2013; Adesanya et al., 2020; Božić, 2017; Nuertey, 2015; SN & Sen, 2017; Sen & Sinha, 2017). Yet, the role of institutional quality in agri-food processing firm performance is not well established in the literature. This study sampled agri-food processing sectors in Ghana to understand agri-food value chain transparency and the role of institutional quality in the relationship between value chain transparency and agri-food processing firms’ performance for three reasons. First, agri-food processing is among the largest manufacturing sectors in Ghana (Ghana Statistical Service [GSS], 2020; 2018). Secondly, the International Trade Centre [ITC] (2016) have all cited compliance with market access requirements, especially Sanitary and Phyto-sanitary Standards (SPS), high cost of raw materials, bottlenecks in government administration associated with regulation, control, application procedures and functions of public agencies, unofficial payments for public services, financing, and insufficient availability and access to information, among others as the crucial challenges responsible for the declining performance of the sector. In addition, although various stakeholders, including the government, have instituted initiatives and reforms to remedy the situation (International Trade Centre [ITC], 2016), the effects of these remedies remain unclear. Ghana’s agri-food firms’ performance remains low compared to other world regions. The next section in this paper reviews the literature to hypothesise the influence of agri-food value chain transparency and institutional quality on agri-food processing firms’ performance. Sections 3, 4, 5 and 6 describe the research methods, results, discussion and conclusions, and the research implications, respectively.

1.1. Relevant literature review and conceptual model development

1.1.1. Overview of the agri-food value chain in Ghana

Ghana sits in the agro-ecological zone of Sub-Saharan Africa geographically, making agriculture the most dominant and ancient economic activity in the country. However, due to perishability and market access challenges, processing of the agricultural products has become very significant to the country’s growth, development, and sustainability. Historically, processing agricultural products and perishable commodities into food (food Industry) and other products are ancient. The origin of the agri-food industry
dates back to the Neolithic agriculture and settlement, which includes manufacturing flour and meal from cereal, distillation, drying and smoking of meat and fish, cheese making, and fermentation to make beverages. In addition, the availability of other support services such as finance, logistics, and technical expertise backed the prosperity of the country’s agri-food value chain to grow beyond the country’s borders for substantial economic gains such as the creation of sustainable jobs, growth of GDP, and elimination of poverty (ITC, 2021; Ghana Export Promotion Authority [GEPA], 2018; Ministry of Trade and Industry (MoTI), 2018).

These speculated prospects of the agri-food industry attracted several companies, including Blue Skies, Casa De Ropa, Tonggu Fruits, Ekumfi Fresh, Unilever Ghana, FanMilk Ghana, and other small-scale entrepreneurs and traders, that process the agricultural food products for both the international and the local market daily. According to T. Allen et al. (2018), S. Allen et al. (2019), and Ghana Statistical Service [GSS] (2018) and ITC (2021), approximately 60 per cent of the total jobs are in the food economy (about 40% is in agriculture and 20% in food processing, food marketing and food stalls and restaurants) in Ghana. The share of food processing in the total manufacturing jobs in Ghana is approximately 40 per cent (Department of International Development [DFID], 2018). The DFID (2018) contended that urbanisation and Ghana’s closeness to large economies such as Nigeria are responsible for the brightest prospect of the agri-food industry in Ghana since the urban population depends on purchased food and changes diets with high demand for processed food.

Ghana’s agri-food value chain comprises input suppliers, producers, wholesalers, processors, distributors, retailers, exporters, and importers (Nyamah et al., 2017). These actors come together to undertake daily operational synchronisation, ensuring that they collectively deliver the best value at each value point (node). The value chain synchronisation begins when the input suppliers provide the inputs to the producers. However, most of these inputs are not manufactured locally but instead imported (DFID, 2018). The government and other stakeholders primarily sell the inputs to the producers at subsidised prices or as trade credits (Nyamah et al., 2017). Usually, the producers convert the inputs into outputs or produce and sell to the wholesalers, who sell to the processors, exporters and retailers. However, the current changing business model has seen processors buying directly from the producers. Some processors even go the extra mile to partner with producers to invest in the production process and monitor it for economical and quality reasons. Figure 1 presents the agri-food value chain in Ghana.

2. Agri-food value chain and performance

Michael Porter developed and popularised the Value Chain concept in 1985 with the publication of ‘Competitive Advantage,’ a seminal work on implementing a competitive strategy to achieve superior business performance. Porter defined value as the price at which buyers are willing to pay for a product or service. He described the ‘value chain’ as a collection of nine generic value-added activities within a business that collaborate to provide value to customers. These activities are broadly classified into three; support services (infrastructure, technology, procurement and human resource management), product-related activities (inbound logistics, operations and service), and market-related activities (outbound logistics, marketing and sales). Porter connected multiple firms’
value chains to create what he referred to as a Value System; however, in today’s era of increased outsourcing and collaboration, the connection between multiple firms’ value-creating processes is more commonly referred to as the ‘value chain.’ As the names suggest, value chains are primarily concerned with customer benefits, the interrelated processes that create value, and the arising demand and funds flow. Profitable value chains generate revenue and improve performance.

Lambert and Cooper (2000) posited that value chains refer to a collection of businesses in which activities, functions, and integrated processes provide superior value to end-users and, in turn, benefit all players. Dyer and Singh (1998) and Barney (1991) argued that actors hope to enhance their overall competitive advantage by pooling their objectives, information, risks, resources, and knowledge, to operate subcomponents in a system. However, this pooling of resources, strategies and objectives must follow articulated principles as provided by the information theory (C. E. Shannon, 1948; Hartley, 1928; Nyquist, 1924; C. Shannon, 1953). Indeed, an information imbalance in the value chain will create functional disorders, resulting in market failure or dissatisfaction (Ahmed & Omar, 2019; Han & Dong, 2015). As posited by the system theory, all the actors or nodes in the value chain must ensure the desired value is realised at each value point since a deviation of any node ruins the entire value chain’s efficiency and effectiveness (Ahmed & Omar, 2019; Bateman & Bonanni, 2019; Bertalanffy, 1969; Dörnhöfer et al., 2016; Miller, 1978). However, information sharing is not limited to members of the value chain; it also involves the external environment as the system theory holds that firms do not operate in a vacuum (Bateman & Bonanni, 2019; Dörnhöfer et al., 2016). According to Rajan and Zingales (2003), strong institutional quality matters, especially when tempering interest group’s activities. That is, an economy’s institutional quality might slow or speed up the performance of business entities.
Sekoenya (2019) noticed that firm performance’s definition and measurement continue to challenge scholars due to its complexity. This study attempts to contribute to this effort by creating and testing a subjective scale of performance that covers the domain of business performance in the words of Venkatraman and Ramanujam (1987), Fernando and Saththasivam (2017), and Ahmed and Omar (2019). The study based its performance argument on the system, information, and institutional theories, distinguishing between performance antecedents and outcomes. The theories’ assumptions also provide a conceptual structure to define performance indicators and dimensions, as depicted in Figure 2 (Aduda & Gitonga, 2011). Moreover, SN and Sen (2017), Fernando and Saththasivam (2017), Bateman and Bonanni (2019), and Ahmed and Omar (2019) have all pointed out that all non-financial dimensions of firm performance will lead to financial performance, supporting the choice of measurements in this study.

3. **Agri-food industry regulation institutions in Ghana**

According to Selznick (1949) and Everett (1939), institutions represent formal and informal laws, regulations, and standards. These laws, standards, and regulations define the codes of conduct, behaviour, and patterns that build the complex constructs that determine human relationships and influence companies’ strategies and decision-making. North (1993) averred that institutions represent the ‘rules of the game’ in an economy, while firms and entrepreneurs stand for the economy’s players or business entities. In the views of Baumol (1990), Williamson (2008), and Bylund and McCaffrey (2017), legal and regulatory systems providing central machinery to this end are essential components of supply chain environments because institutions set 'the rules of the game'
for everyday market exchange and its governance. Firms are rarely self-sufficient and hence interact with other entities in their environments to acquire resources for survival, efficient and effective performance, and growth, as suggested by the system theory.

In Ghana, the Food and Drugs Authority, the Ghana Standards Authority, the Ministry of Food and Agriculture, the Environmental Protection Agency, occupational safety and hazard legislations, Ghana Export Promotions, the Council of Scientific and Research Institution, Ministry of Trade and Industry, Ghana Revenue Authority, the Registrar General’s Department, the 1992 Constitution, and other trade unions such as the association of Ghana industries, and other community values, principles, decrees and culture regulate the agri-food industry. Of course, consumer preferences and behaviour also form part of institutions and shape the conduct of firms in any society. Aside from these, there are other international codes of conduct, such as the International Organization for Standardization (ISO).

4. Theoretical viewpoint of the study

The system and information theories have provided foundational grounding for supply chain transparency as a partially explained branch of supply chain management and, specifically, sustainable supply chain management (Bastian & Zentes, 2013). The system theory emphasised the principles common to all complex entities in a dynamic relationship like a supply chain network. Bertalanffy (1969) posited that a system is more than just a sum of sub-components, noting that holistic interactions and mutual dependency remain critical for the effective functionality of every system. However, this dependency and interactions are only possible through sufficient and effective information flow as outlined by the information theory (Ahmed & Omar, 2019; Miller, 1978).

The information theory held that in any organisational system, the different components or functions work as a sender and a receiver engaged in sending and receiving output and input information simultaneously (Desouza et al., 2003). The information theory stressed the importance, collection, quantification, processing, storage, medium, and dissemination of information (C. E. Shannon, 1948; Hartley, 1942; Nyquist, 1924). In a collaborative channel like a supply chain, where numerous parties collaborate to meet a customer’s need, information flow is critical, just as oxygen flow is in a human system, where a distortion creates serious problems.

That notwithstanding, information flow and other interactions among the firms in the network pass through structures within their operating environments. Thus, the institutional theorists argued that organisations operate within a social network (such as culture, laws, and regulations), and their behaviours are not confined to a dyadic relationship (Anderson et al., 1994; Iacobucci & Hopkins, 1992; Meyer & Rowan, 1977; Scott, 1987). It implies that the substantial motivating or compliance force behind firm behaviour is socially based and embedded within institutions and interconnected organisational networks. Hence, supply chains represent a system (system theory) whose success depends on smooth and transparent information flow (supply chain transparency), as posited by the information theory, operating within social and regulatory structures (institutional theory).
5. Empirical literature and hypothesis development

5.1. Supply chain transparency and agri-food processing performance

Supply chain transparency has been linked to positive firm performance. For instance, transparency motivates consumer purchasing decisions, increasing the performance of firms (Buell & Kalkanci, 2021). In addition, other studies such as Kumar and Ganguly (2020) indicated that firms’ performance improves when supply chain transparency is practised. Mohan, Buell and John (2019) revealed that transparency practices among firms, such as the disclosure of variable costs associated with product production, improve performance. Previous studies also showed that transparency, for instance, in a supply chain network, improve firms’ operational, supplier, and technical performance (Ahmed & Omar, 2019; Bastian & Zentes, 2013). Practically, Hwarng and Yuan (2016) found that food firms that allow customers to see the food production process through a glass-enclosed kitchen improve their performance. From the system theory and the information theory perspective, supply chain transparency will lead to higher performance of firms in the supply chain (Ahmed & Omar, 2019; Hung et al., 2011; Miller, 1978; Sarkis et al., 2011).

Therefore, the first hypothesis is as follows: H1. The higher the transparency in the agri-food chain, the higher the processors’ performance.

5.2. Institutional quality and firm performance

The institutional theorists averred that institutional quality shapes firm behaviour and outcome (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; North, 1990; Scott, 1987). Although the role of institutions, defined as ‘the rules of the game in a society,’ on economic performance and growth has long been acknowledged, empirical studies that examine the institutional quality and firm performance nexus have lagged and are limited in the supply chain management field because of data deficiencies. However, Bhaumik et al. (2018) showed significant intra and intercountry differences in the impact of institutions on firm performance, as measured by productivity. Bhaumik et al. further held that the relative effect on performance and factor inputs varies across countries, implying that imposing the same institution in different countries can have very different effects on labour’s share of output and income distribution.

Similarly, SN and Sen (2017) found that bureaucratic corruption negatively affects firm productivity. Lafontaine et al. (2017) postulated that regulatory considerations and institutional quality affect the behaviour of firms in the service sector. Similarly, Vanacker et al. (2021) contended that institutional quality influences firm performance. Though Ahmed et al. (2020) studied just one element of firm performance (environmental performance), they found that institutional pressure significantly improves the environmental performance of firms.

In Ghana, although a few studies, such as International Trade Centre [ITC] (2016), Nuertey (2015), and Ameyaw et al. (2012), identified institutional quality as a challenge to firm performance and the implementation of the public procurement law 2003 (Act 663), its effect on firm performance has not been empirically examined. But Nyamah
et al. (2017) found that policy/regulations and political-related issues (institutional issues), as a source of risk, insignificantly affect Ghana’s agri-food supply chain’s performance.

However, this study hypothesised that (H$_2$) institutional quality has a significant positive effect on agri-food processing firms’ performance.

### 5.3. Institutional quality and supply chain transparency

The institutional environment’s efficiency and effectiveness can explain the variations in supply chain transparency adoption and practices by firms per the institutional theory. In that respect, institutional quality may define and shape firms’ supply chain transparency behaviours or efforts. Thus, Villena and Dhanorkar (2020) argued that suppliers lacking climate change incentives are more susceptible to coercive and mimetic pressures, whereas suppliers with climate change incentives are more receptive to normative pressure regarding their level of carbon transparency. They posit that climate change increases firms’ vulnerability to institutional pressure, whereas improved regulatory quality increases transparency.

Several other studies, such as Ahmed and Omar (2019), Bastian and Zentes (2013), Heras-Saizarbitoria and Boiral (2012), and Trienekens et al. (2012), and Prajogo et al. (2012) have all argued that supply chain transparency can be improved through the proper implementation of standards and the availability of quality institutions, which fosters a shared understanding of how businesses should be managed. Greer and Purvis (2016) continued by stating that various acts, legislation, and standards have been developed to increase supply chain transparency and prevent supply chain members from deviating from their actual operational objectives.

Thus, this study hypothesised (H$_3$) that institutional quality has a significant positive effect on supply chain transparency.

### 5.4. Supply chain transparency, institutional quality, and firm performance

Limited empirical works support the proposition that strong institutional quality and supply chain transparency are necessary for firms to attain high performance. That is, supply chain transparency alone may not lead to the desired levels of firm performance unless there is a strong institutional quality (SN & Sen, 2017). This could explain why there are mixed findings on the relationship between supply chain transparency and firm performance. According to Božić (2017), socially responsible national legal regimes and the diffusion of technological innovations are required to increase social transparency in global supply chains. Božić (2017) demonstrated that the degree of external transparency increases with brand size, which is influenced by supply chain transparency-related legislative acts. Božić added that information asymmetry and the absence of a standardised auditing system negatively impact external and, ultimately, internal transparency. In Ghana, International Trade Centre [ITC] (2016), Nuertey (2015), and Ameyaw et al. (2012) argued that the extent to which firms will comply with regulations and ensure transparency to promote their performance depends on the quality of the institutions.
Therefore, this study hypothesised \((H_4)\) that institutional quality positively moderates the effect of supply chain transparency on firm performance.

6. Conceptual framework

The study’s conceptual framework is designed based on the ideas obtained from the arguments of the system theory, the information theory, the institutional theory, the concepts reviewed, and the findings of various empirical studies relevant to this study. The conceptual framework becomes relevant as variables measuring the specific objectives do not flow directly from the research theories. Thus, this study used concepts based on the ideas from literature as proxies to measure the variables in the objectives. The framework contains three main variables: supply chain transparency, institutional quality, firm performance, and control variables.

The dependent variable (firm performance) was proxied with five dimensions as operational performance, social performance, ecological performance, relationship performance, and supplier performance. Sekoena (2019) observed that defining and quantifying firm performance has been challenging for scholars due to its complexity. This study contributes to this effort by developing and testing a subjective performance scale that, in the words of Venkatraman and Ramanujam (1987), Fernando and Saththasivam (2017), and Ahmed and Omar (2019), covers the domain of business performance. The study based its performance argument on the system, information, and institutional theories, distinguishing between performance antecedents and outcomes. The theories’ assumptions also provide a conceptual structure to define performance indicators and dimensions (Aduda & Gitonga, 2011).

**Figure 2** portrays that supply chain transparency (as an independent and dependent variable) and institutional quality are measured using indicators, as contained in the questionnaire of this study. From the literature, institutional quality significantly influences supply chain transparency (Ahmed & Omar, 2019; Bastian & Zentes, 2013; Greer & Purvis, 2016; Villena & Dhanorkar, 2020).

7. Research methods

The validated survey instrument was derived from the ideas of Bastian and Zentes (2013), Ahmed and Omar (2019), Božić (2017), SN and Sen (2017), Kraft et al. (2018), and Mohan et al. (2019). The questionnaire is divided into four sections. The first section contains questions relating to the demographic information of the respondents. The second section contains questions on the respondents’ perception of supply chain transparency. The third section contains questions relating to the respondents’ perception of institutional quality, while the last section contains questions on different aspects of firm performance. The study employed a five-point Likert scale as items in sections two to four are in scale format. The instrument’s validity is thoroughly in respect of content validity, convergent validity, discriminant validity and so on via a confirmatory factor analysis using SmartPLS.

The advantages of this survey instrument are cost and time economy, ensuring respondents’ anonymity, objectivity, and ability to reach a wider coverage. Furthermore, it ensures the inclusion of relevant items encompassing the dimensions
of the various variables based on literature review, ratification of these items by the experts within the supply chain fraternity in both the industry and the academia, and finally, rigorous testing of the items through appropriate statistical tests. The disadvantages of the instrument involve the possible limitation to the literate population and do not provide an opportunity to collect additional information or allow the respondents to express further views on the topic under investigation. However, all the respondents captured with this questionnaire were literates and could read and understand the items as expected. In addition, the structured nature of the questionnaire helped keep the study focused (Osuala, 2001; Sekoenya, 2019).

The survey was carried out on the agri-food processing firms operating in Ghana. Agri-food processing firms turn agricultural products, such as raw tubers, wheat kernels or livestock, into something that can prevent them from going bad or make them eatable or edible. It also includes firms that create food from agriculture ingredients ready to use or primarily processed or have already undergone primary processing. This study considers agri-food processing firms that are primary and secondary food agri-food processors. This is because some firms combined both stages. For example, a Kenkey producing firm may combine both preparation and frying of fish and meat, processing vegetables, and secondary processing of dried corns into food (kenkey). The agri-food processing firms are a component of the manufacturing subsector of Ghana’s industrial sector.

The study selected agri-food processing firms because of their value, sensitivity to health, and contribution to economic growth and development. According to the Ghana Statistical Service [GSS] (2020) and the Ministry of Trade and Industry (MoTI; 2018), food processing is the major contributor among 23 activities under the manufacturing subsector in Ghana, contributing over $12.3 billion annually to GDP. Agri-food processing is crucial to the Ghanaian economy, especially as there are high logistics and infrastructure risks in Ghana’s agriculture production. According to the Ghana Enterprise Survey by the Ghana Statistical Service [GSS] (2015), Ministry of Trade and Industry (MoTI; 2018), p. 17,471 firms are classified in agri-food processing under the Manufacturing subsector in Ghana. The study employed the simple random sampling technique to select the respondents (one respondent per firm). The number of respondents was estimated using the Yamane (1967) sample size determination formula, which gave 391, assuming a 95% confidence interval.

To obtain data from the prospective respondents, questionnaires were administered offline and online. In the case of offline mode, the researchers booked prior appointments with the respondents. Then, the questionnaires were hand-delivered to the respondents by the researchers, where they explained the instrument to them to have a better understanding of different facets of the concepts and terms that may look unfamiliar to the respondents. Initially, the prospective respondents were contacted telephonically and requested to provide their valuable inputs in the online mode. Those who consented to participate in the survey received an online questionnaire (in Google Form). After receiving responses via online mode, the completed questionnaires were analysed to determine whether respondents provided meaningful inputs. The online questionnaire received a small number of responses, while most responses were obtained offline. A total of 400 questionnaires were distributed, but 367 questionnaires were filled and returned. This represents a response rate of 91.75 per cent. However, 320, representing 80.81 per cent of
the sample size, were valid for the statistical analysis. This is appropriate because Dillman (2011), Millar and Dillman (2011), Morton et al. (2012), and Af Wåhlberg and Poom (2015) have all posited that a response rate of above 60 per cent for a mixed or general survey is appropriate for empirical analysis.

The study relied on the positivist research paradigm. As required by the positivists, this study used the quantitative research approach and the explanatory research design (Saunders et al., 2012). Creswell (2014) and Saunders et al. (2012) explained that the quantitative research approach involves measuring variables typically on instruments, so that numbered (quantitative) data can be analysed using statistical procedures. Furthermore, empirical research that seeks to explain the current status of a phenomenon and establish cause and effect relationships between variables may be termed explanatory (Saunders et al., 2012). The study used SmartPLS version 3.3, Statistical Package for Social Sciences (SPSS), version 26, and Microsoft Excel 365 for the data processing based on availability and appropriateness per statistical relevance. The study used structural equation modelling to analyse the data.

8. Results

8.1. Diagnostic tests

This study employs confirmatory factor analysis via a repeated indicator approach (RIA) in SmartPLS to conduct the factor analysis to validate the data used for this study. The RIA advocated that a factor analysis supports the reflective constructs or first-order variables and the formative order variables in a given study (Gaskin, 2012). This was imperative for this study because one of the exogenous and the endogenous variables used in the model have dimensions used to measure them. In using the RIA, this study relied on the principles of Hair, Sarstedt et al. (2019), Hair, Risher et al. (2019), Gaskin et al. (2018), and Hair et al. (2017), and Kock (2015); Kock (2017), Henseler et al. (2015), and Lowry and Gaskin (2014). The result is shown in Figures 3 and 4 and Table 1. Figure 3 shows that all the reflective factor loadings are above the minimum threshold of 0.5. Figure 4 shows the t-values of the reflective factor loading, which are greater than the minimum threshold of 1.96, indicating that the constructs are suitable measures of the variables. Table 1 shows the reliability and consistency statistics of the formative constructs. Table 1 shows that all the AVE are above 0.5, and the composite reliability is also above 0.6 and less than 0.95.

Table 2 also shows that all the square roots of the AVE of each latent variable (thus, the diagonal values of the Fornell-Larcker criterion) are larger than the latent variable correlations. For descriptive purposes, Table 2 also presents the mean and standard deviations of the variables before their standardisation as formative constructs. Table 3 presents the variance inflationary factor (VIF) to check for multicollinearity and common method bias. Table 3 shows that all VIFs resulting from the full collinearity test are lower than 3.3, indicating that the model is free of common method bias.
9. Hypothesis testing

The results of hypotheses 1 to 4 are presented in this section. Figure 5 presents the model assessing the effects of supply chain transparency and institutional quality on firm performance and supply chain transparency, representing hypotheses 1, 2, and 3,
Table 1. Internal consistency reliability and convergent validity.

| Constructs        | Cronbach's Alpha | rho_A | Composite Reliability | Average Variance Extracted (AVE) |
|-------------------|------------------|-------|------------------------|---------------------------------|
| Ecological        | 0.806            | 0.808 | 0.806                  | 0.673                           |
| Institutional Quality | 0.857            | 0.865 | 0.858                  | 0.705                           |
| Operational       | 0.820            | 0.821 | 0.819                  | 0.681                           |
| Relationship      | 0.830            | 0.845 | 0.837                  | 0.537                           |
| SCTcoft           | 0.893            | 0.898 | 0.894                  | 0.716                           |
| SCTosc            | 0.936            | 0.940 | 0.937                  | 0.741                           |
| SCTv              | 0.908            | 0.912 | 0.908                  | 0.639                           |
| Social            | 0.785            | 0.793 | 0.782                  | 0.547                           |
| Supplier          | 0.763            | 0.778 | 0.774                  | 0.624                           |

Note: Ecological denotes Ecological performance; Operational denotes Operational performance; Relationship denotes Relationship performance; Social denotes Social performance; Supplier denotes Supplier performance; SCTv represents visibility dimension of Supply Chain Transparency; SCTosc represents Operations and Sustainability Conditions at the purchasing firm as a dimension of Supply Chain Transparency; SCTcoft represents Cost and Other Financial Transparency as a dimension of Supply Chain Transparency.

Table 2. Fornell Larcker criterion for the formative constructs and their descriptive statistics before standardisation.

|        | Mean | Std. Dev | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
|--------|------|----------|----|----|----|----|----|----|----|----|----|
| Ecological | 2.591 | 0.954 | 0.820 | | | | | | | |
| Institutional Quality | 3.013 | 0.886 | 0.082 | 0.840 | | | | | | |
| Operational | 2.648 | 0.863 | 0.308 | −0.140 | 0.825 | | | | | |
| Relationship | 2.563 | 0.884 | 0.478 | −0.033 | 0.275 | 0.733 | | | | |
| SCTcoft | 2.614 | 0.863 | 0.042 | 0.798 | −0.143 | −0.046 | 0.846 | | | |
| SCTosc | 2.447 | 0.879 | 0.032 | 0.823 | −0.196 | −0.086 | 0.810 | 0.861 | | |
| SCTv | 2.605 | 0.872 | 0.054 | 0.726 | −0.221 | −0.047 | 0.700 | 0.813 | 0.799 | |
| Social | 2.714 | 0.883 | 0.430 | 0.042 | 0.381 | 0.422 | −0.020 | −0.043 | −0.023 | 0.740 |
| Supplier | 2.655 | 0.884 | 0.389 | 0.001 | 0.117 | 0.626 | 0.045 | 0.036 | 0.071 | 0.196 | 0.790 |

Note: Ecological denotes Ecological performance; Operational denotes Operational performance; Relationship denotes Relationship performance; Social denotes Social performance; Supplier denotes Supplier performance; Std. Dev means standard deviation; SCTv represents visibility dimension of Supply Chain Transparency; SCTosc represents Operations and Sustainability Conditions at the purchasing firm as a dimension of Supply Chain Transparency; SCTcoft represents Cost and Other Financial Transparency as a dimension of Supply Chain Transparency.

respectively. However, the values in Figure 5 are not the total specific effects of each of the independent variables on the dependent but the combined effects. Table 4 summarises the various independent variables’ specific direct and indirect effects on the dependents.

From Table 4, supply chain transparency has a significant positive effect on firm performance ($R^2 = 0.476$; $p = 0.000$). Thus, supply chain transparency explained 47.6% of the total variation in firm performance. The significant positive coefficient of determination (0.476) of supply chain transparency on firm performance means that a unit increase in supply chain transparency will lead to a 47.6% increase in firm performance, all things being equal. The significance of this result is the corresponding t-value for the regression, which is greater than 1.96, thus 13.335, and a p-value of 0.000. The standard deviation of 0.036 in Table 4 for this result shows little variation in the computation, which is evident in the similarity between the R-square and the Adjusted R-Square.

Also, the result in Table 4 indicated that institutional quality has a significant positive effect on firm performance, explaining a whopping 87.5% of total performance and significant at a p-value of 0.000 and t-value of 71.317 ($R^2 = 0.875$; $p = 0.000$; $t = 71.317$). This means that a unit increase in institutional quality will
lead to an 87.5% increase in firm performance in Ghana. The relatively small standard deviation of the result (0.012) shows few variations (errors) in the computation of the variables, as evidenced in the similarity between the Adjusted R-Square and the R-Square.
Regarding the third hypothesis, Table 4 depicts that institutional quality has a significant positive effect on supply chain transparency ($R^2 = 0.797$; $p = 0.000$; $t = 42.077$). Thus, institutional quality explains 79.7% of supply chain transparency in Ghana, significant at less than 1 per cent with a t-value of 42.077, ceteris paribus. This result pulled a standard deviation of 0.019, indicating little variations in the computations as evidenced in closed similarities between R-Square (0.797) and an adjusted R-Square of 0.796.

Finally, Table 4 presents the specific total indirect effect of institutional quality on firm performance. Table 4 shows that institutional quality has a significant indirect effect on performance through supply chain transparency ($R^2 = 0.380$; $p = 0.000$; $t = 12.808$).

The results for the last hypothesis, moderating role of institutional quality in the relationship between supply chain transparency and firm performance, are presented in Figure 6 and Table 5.

Figure 6 shows that institutional quality positively moderates the relationship between supply chain transparency and firm performance. Notice that the coefficient of determination of firm performance has increased from 0.848 in Figure 5 to 0.852 in Figure 6. Also, the relationship between supply chain transparency and firm performance has improved from 0.476 to 0.484. The coefficient of the moderation is shown as 0.051, significant at 5 per cent. This implies that institutional quality matters to strengthen the effect of supply chain transparency on firm performance. The detailed total specific direct and indirect effects of all the variables in this model with their significance tests are presented in Table 5.

It is evidenced in Table 5 that the t-values for the regression model are greater than 1.96, indicating that the moderating effect of institutional quality on the relationship between supply chain transparency and firm performance in this model is significant ($R^2 = 0.051$; $p = 0.015$; $t = 2.448$). The model is significant; hence there is a statistically significant positive effect of institutional quality on the relationship between supply chain transparency and firm performance, confirming that institutional quality improves the effect of supply chain transparency on firm performance in Ghana.

Figure 6. Moderating effect of institutional quality on the relationship between supply chain transparency and firm performance.
Table 5. Total and indirect effect of the model.

| Effect | Original Sample (O) | Sample Mean (M) | Std. Dev (STDEV) | T Statistics (|O/STDEV|) | P Values |
|--------|---------------------|-----------------|------------------|----------------|----------|
| IQ -> FP | 0.873               | 0.873           | 0.013            | 68.32          | 0.000    |
| IQ -> SCT | 0.797               | 0.797           | 0.019            | 41.034         | 0.000    |
| Modelling Effect of Institutional Quality -> FP | 0.051               | 0.051           | 0.021            | 2.448          | 0.015    |
| SCT -> FP | 0.484               | 0.484           | 0.036            | 13.575         | 0.000    |
| Total Specific Indirect Effect | 0.386               | 0.386           | 0.033            | 11.8339        | 0.000    |

Note: FP denotes firm performance; IQ denotes Institutional Quality; and SCT represent Supply Chain Transparency.

The study presents the total effect, predictive relevance test, and the model fit report in Table 6 to provide more evidence for the model estimated.

Table 6 presents the predictive relevance test of the model. According to Wong (2016), assessing Stone-Geisser’s predictive relevance (Q2) is critical because it determines whether the indicators’ data points accurately measure the endogenous construct. From Table 6, the proposed model has good predictive relevance for all the endogenous variables. Chin (1998) suggested that a model demonstrates good predictive relevance when its Q^2 value is larger than zero. Also, the overall model fitness is presented in Table 6. As contained in Table 6, the model fits the purpose because it meets the quality criteria for PLS-SEM model estimation. For Standardised Root Mean Square Residual (SRMR) and Normed Fit Index (NFI) or Bentler and Bonett Index values, thresholds of SRMR < 0.08 and NFI > 0.90 are accepted for good for purpose model (Dijkstra & Henseler, 2015; Hair et al., 2017; Henseler et al., 2014). From Table 6, both the SRMR and the NIF have met the decision criteria.

10. Robustness and sensitivity tests

This section presents the control variables or the exogenous variables that may hold alternative explanations for the independent variable. This study controlled exogenous variables such as firm age, firm location, firm size, and the firm ownership type thought to hold alternative explanations for the independent variable. The distribution of these variables is in Figure 7 in the appendix. All the models estimated in this study contain firm performance as a dependent variable. As expected, all the control variables have varying degrees of effect on the endogenous variable. However, all the effects are very minimal and insignificant. From Table 7, firm ownership and firm age have less than one per cent effect, 0.007 and 0.002 respectively, on firm performance. This means that a unit change in these variables will lead to less than one per cent change in firm performance.

Table 6. Predictive relevance (Q^2) and model fitness statistics.

| Model Fitness Statistics | Saturated Model | Estimated Model |
|--------------------------|-----------------|-----------------|
| SRMR                     | 0.000           | 0.001           |
| Chi-Square               | 0.000           | 0.076           |
| NFI                      | 1.000           | 1.000           |
For firm location and firm size, they have 3.6% and 2.6%, respectively, on performance. This means that a unit change in firm location and size will lead to a 3.6% and 2.6% increase in firm performance. Since these effects of the exogenous variables are not significant, the high effect of the independent variables on the dependent variable in the models is not due to the influence of exogenous variables.

11. Overall sensitivity analysis

The final robustness test presents a sensitivity analysis of the F-Square (F$^2$) statistics of the model. Wong (2016) and Lowry and Gaskin (2014) argued that the F$^2$ test assesses the effect of a specific exogenous construct on the endogenous construct if it is deleted from the model. Cohen (1988) pointed out that F$^2$ values of 0.02, 0.15, and 0.35 are interpreted as small, medium, and large effect sizes. From Table 8, the exogenous (control) variables do have an insignificant F$^2$ effect or no effect at all on the endogenous variable since the F$^2$ values are less than 0.02, way less than what Cohen (1988) described as a small effect (0.02).

However, the F$^2$ statistics of institutional quality (IQ) and supply chain transparency (SCT) on firm performance (FP) are all well above 0.5, indicating that they have a significant effect size in the model. Thus, Table 8 confirmed no exogeneity in the models presented in this study. The significant effects of the independent variables on the dependent variable are not coming from outside the model, nor are they unexplained by the model.

12. Discussion and conclusion

This study formulated four hypotheses: H1. Supply chain transparency positively influences the performance of agri-food processing firms in Ghana, H2. Institutional quality positively influences the performance of agri-food processing firms in Ghana, H3. Institutional quality positively influences supply chain transparency and H4. Institutional quality positively moderates the relationship between supply chain transparency and the performance of agri-food processing firms in Ghana. The results indicated that all four hypotheses are supported. However, controlling for the effect of control variables, thus, the firm’s age, size, location, and ownership type do not significantly influence the endogenous variables as evidenced in the results.

Table 7. Full model report with control variables.

| Constructs | Original Sample (O) | Sample Mean (M) | Std Dev (STDEV) | T Statistics (|O/STDEV|) | P Values |
|------------|---------------------|-----------------|-----------------|---------------------|----------|
| Firm OwnershipType -> FP | −0.007 | −0.008 | 0.032 | 0.202 | 0.840 |
| FirmAge -> FP | 0.002 | 0.002 | 0.025 | 0.082 | 0.934 |
| FirmLocation -> FP | 0.036 | 0.036 | 0.024 | 1.508 | 0.132 |
| FirmSize -> FP | 0.026 | 0.025 | 0.037 | 0.706 | 0.480 |
| IQ -> FP | 0.496 | 0.498 | 0.037 | 13.251 | 0.000 |
| IQ -> SCT | 0.797 | 0.797 | 0.02 | 40.772 | 0.000 |
| SCT -> FP | 0.476 | 0.474 | 0.038 | 12.436 | 0.000 |

FP denotes firm performance; IQ denotes Institutional Quality; and SCT represent Supply Chain Transparency.
Hypothesis H1 showing that supply chain transparency positively influences the performance of agri-food processing firms in Ghana is strongly supported. This is because greater supply chain transparency tends to undermine the power of the monopolists, who most often hoard information to their benefit, thereby making other firms visible in the supply chain. Also, the availability of information reduces the risk of market failure, an anomaly caused mainly by information asymmetry, and this is the main argument of the information theory by Nyquist (1924), Hartley (1928, 1942) and C. E. Shannon (1948); C. Shannon (1953). This finding aligns with Buell and Kalkanci’s (2021) results, which explained that transparency into internal and external responsibility initiatives tends to dominate generic brand marketing in motivating consumer purchases, supporting the view that consumers take companies’ responsibility efforts into account in their decision making. This is because the world is moving quickly toward an information era where productive units rely heavily on information sharing to achieve their daily operational goals.

This result is also consistent with the findings of Kumar and Ganguly (2020), Mohan, Buell, and John (2019), Ahmed and Omar (2019), Kraft et al. (2018), Craig et al. (2017), Buell et al. (2017), and Kalkanci et al. (2016), and Egels-Zandén et al. (2015), and Bastian and Zentes (2013). This indicates that consumers may soon not value the prices of commodities they purchase but instead focus on the transparency of the supply chain that produces such commodities is relevant in Ghana. Thus, companies that wish to stay relevant and competitive need to take transparency as seriously as their competitive resources or strategies.

The second hypothesis of this study showing the effect of institutional quality on the performance of agri-food processing firms in Ghana is also supported. The results indicated that institutional quality had a significant positive effect on the performance of agri-food processing firms in Ghana. This is in line with the institutional theory put forth by Meyer and Rowan (1977), DiMaggio and Powell (1983), Zucker (1987), Meyer, Rowan, Powell, and DiMaggio (1991), North (1990) and Scott (1995). Meyer and Rowan (1977), North (1990) and Scott (1995) explained that legal origins, the rules themselves as well as the quality of their enforcement shape the behaviour and performance of firms in any given society. The finding is also in agreement with the results of Vanacker et al. (2021), Bhaumik et al. (2018), SN and Sen (2017), and Sen and Sen (2017), and Lafontaine et al. (2017). However, this finding refutes the results of Ahmed and Omar

| Table 8. F-Square statistics of the full model. |
|------------------------------------------------|
| **FP** | **SCT** |
| Firm Age | 0.000 |
| Firm Location | 0.007 |
| Firm Ownership Type | 0.000 |
| Firm Size | 0.001 |
| IQ | 0.594 |
| SCT | 0.548 |

Note: FP denotes firm performance; IQ denotes Institutional Quality; and SCT represent Supply Chain Transparency.
(2019), who found that institutional pressure has an insignificant negative impact on the economic performance of firms. Their result or finding could be because of their weak conceptualisation and definition of the institutional pressure variable.

Furthermore, the third hypothesis was also supported since the result indicated that institutional quality is a significant positive predictor of supply chain transparency in Ghana. This finding is in line with those of Villena and Dhanorkar (2020), Ahmed and Omar (2019), Greer and Purvis (2016), Bastian and Zentes (2013), and Heras-Saizarbitoria and Boiral (2012), and Trienekens et al. (2012), and Prajogo et al. (2012).

Finally, the fourth hypothesis that institutional quality positively moderates the relationship between supply chain transparency and the performance of agri-food processing firms in Ghana is also supported. Results from the model in Figure 6 depicted a fascinating phenomenon. The interaction term between supply chain transparency and institutional quality had a positive coefficient of 0.051, significant at 5%. The introduction of the interaction term causes the supply chain transparency variable to attain a coefficient of 0.484 compared to a coefficient of 0.476 in Figure 5. However, the coefficient of institutional quality attained a lower coefficient in Figure 6 than a relatively higher coefficient in Figure 5. This means that the interaction term reveals the true nature of institutional quality in Ghana. Although the weak nature of institutional quality in Ghana may impede firm performance (International Trade Centre [ITC], 2016; Ghana Statistical Service [GSS], 2020; MoTI, 2018), it compliments supply chain transparency to contribute better to the performance of agri-food processing firms. The net effect of supply chain transparency on firm performance can be estimated from the partial differential of firm performance to supply chain transparency. This explains that supply chain transparency in isolation may not contribute much to firms’ performance in Ghana unless strong institutional quality structures are put in place.

This finding resonates with the position of the institutional theorists who posits that the survival, performance, and legitimacy of corporate practices largely depends on the quality of the institutional environment within which they operate while acknowledging resource usefulness (Hirsch, 1975; Roy, 1997; Scott, 2008; Baumol, Litan, & Schramm, 2007; Bruton, Ahlstrom, & Li, 2010). However, the resourcefulness of the firms measured in terms of size (number of employees), location, age (number of years in operation-experience) and the type of ownership failed to significantly influence the variations in the performance of the agri-food processing firms in Ghana. Empirically, this study supports the findings of Božić (2017). Also, the finding of this study confirms the propositions of International Trade Centre [ITC] (2016), Nuertey (2015), and Ameyaw et al. (2012), who argued that the extent to which firms will comply with regulations and ensure transparency to promote their performance depends on the quality of the institutions within the Ghanaian economy.

13. Implications, recommendations and future research

13.1. Managerial implications for agri-food processing firms in Ghana

This study provides significant insights for agri-food processing firms’ managers, policy decision-makers, and other stakeholders. This study shows that the desired performance of agri-food processing firms operating in Ghana strongly hangs on the level of
transparency along the agri-food value chain and the quality of the institution governing the chain. Therefore, it is prudent for managers of agri-food processing firms to note that improved transparency along their value chain could, for instance, minimises communication or information distortions, lead time, fraud and price hikes to meet food/food product standards across the globe. In addition, to achieve higher performance, it must be the duty of agri-food processing firms managers to extend sound transparency practices to their major suppliers and buyers and their tiers and ensure effective monitoring along their value chains. For instance, gaining insight into the upstream supply chain operations, through increased transparency, will enable the agri-food processing firms to monitor and trace the production and sustainability conditions of the firms that produced the raw materials they use, be able to trace the materials and the various tiers of suppliers involved in their chain. This will help them avoid sourcing from suppliers that supply conflict minerals or resources, use illegal means of exploration or production, and indulge in labour malpractices such as child labour and unfair remunerations. Transparency into the upstream operations will also ensure accurate forecasting as appropriate information flow plays a key role.

For downstream, higher transparency will help the firms manage their distributors and consumers appropriately in the form of feedback usage, and product returns management, expiration tracking, product recalls in times of unfortunate incidents such as contamination and expiration. It will also help the processing firms regulate their products’ pricing by distributors, product end-of-life management, and indiscriminate behaviour of intermediaries, distributors, and retailers. These will build consumer and distributor confidence, increasing their loyalty and patronage, leading to higher performance.

Thus, it is beneficial for the managers to proactively involve themselves in facilitating their suppliers by identifying loopholes in their transparency practices and helping standardised sub-tiers transparency practices as each tier in the supply chain represent a value point. However, enhancing the transparency efforts to a more efficient and effective level may call for substantial investments and radical changes, which may be sophisticated and expensive for some of the tiers in the supply chain. Therefore, business process reengineering can also help in enhancing their supply chain transparency. And with advancement in technology and the relative reduction in its costs, it should be possible and affordable to all firms.

The positive effect of institutional quality on both performance and supply chain transparency means that the high-quality institutions will enhance the operations of the firms and their efforts towards meeting formal standards. For instance, if managers operate independently without interfering in the supervisory role of institutions, the institutions will guide them properly to operate within standards, resulting in producing high quality and competitive products for the local and international markets, which will increase their performance and gains. Quality institutions mean that the agencies don’t take bribes and other unauthorised payments, they don’t discriminate against any firm, irrespective of size, location, and ownership, and guard against product imitations to safeguard the market share and profit of licensed firms. Thus, increasing the quality of institutions in Ghana will enhance equal and just participation by all firms, eliminating the power of the incumbents who often use their connections to subdue and hijack markets, leaving the less-resourced firms wanting. The
institutions will enhance standardisation and enhance best practice utilisation by all members of the industry and the supply chains, leading to greater transparency and performance.

14. Theoretical implications for agri-food processing firms in Ghana

This research enhances the theories used to underpin the study at a theoretical level. For example, the significant positive relationship between supply chain transparency and the performance of agri-food processing firms resonates with the positions of the system theory and the information theory that posit that effective interaction and information exchange among the firms will improve their performance. Thus, when the managers of the agri-food processing firms act in line with the propositions of the system and information theory, it will go a long way to enhance their performance. Also, the results supported the views of the institutional theorists, reechoing that when the firms in a society act within the institutional framework, their performance improves over time. Thus, the appropriate quality of institutions in Ghana and the agri-food processing firms’ ability to operate effectively within the institutional framework will promote their performance.

15. Policy recommendations

Concerning the first hypothesis, it is recommended that managers of the Ghanaian economy and, specifically, the industrial sector stakeholders should continue to institute economic policies that inspire supply chain transparency to enhance firm performance in Ghana. However, with the third hypothesis, such efforts will yield much more effective and efficient firm performance if policies are also implemented to improve the quality of institutions in the economy. Enhancing regulatory quality will also mean governments will formulate and promote sound policies that permit and promote private sector development. Thus, when institutions play their roles well, and the incumbents and the industry players abide by laws, they will respect government policies aimed at even allocation of resources, adequate information sharing, and tempering their opposition to competition. Additionally, the improvements in institutional quality on their own too will yield a positive impact on firm performance in the Ghanaian economies following the second hypothesis.

16. Suggestions for future research

This study suggests that future research look at the supply chain transparency practices in the agri-food processing industry and the degree of concordance of these practices among the agri-food processing firms. It will also be relevant for future studies to look at how technology shapes the transparency efforts in the agri-food processing industry in Ghana.

Disclosure statement

No potential conflict of interest was reported by the author(s).
Data Availability

Data is available on request from the authors.

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Appendix

![Background distribution of the respondents.](image)

Figure 7. Background distribution of the respondents.