Horizontal collaborative communication and operational performance of smallholder farmer's groups in horticultural supply chain in Tanzania

Herieth Rogath[1], Juma James Masele[2] and Gerald Magova[3]

Abstract

This paper examines the relationship between horizontal collaborative communication and operational performance of smallholder farmer's groups downstream of the horticultural supply chain. This was motivated by an increase in postharvest loss and high transaction cost especially in downstream of horticultural supply chain. Using social exchange theory, the study examines the relationship explained. Quantitative data were used to collect data using self-administered questionnaire to 195 horticultural smallholder farmer's groups in southern highland regions including Mbeya, Iringa, Njombe and Songwe. The Questionnaires were administered to a group leader or a member from each of the selected smallholder farmer's group. Data were analyzed using SMART – PLS 4 and the findings show a positive and significant relationship between horizontal collaborative information sharing i.e. information sharing and information quality and operational performance of smallholder farmer's groups in horticultural supply chain. The government and policymakers are advised to formulate policies in the agricultural domain on horizontal collaborative communication that contributes to the achievement of Sustainable Development Goal (SDG) Number 17 as well as to align with the strategic objectives outlined by the Food and Agriculture Organisation (FAO) in 2018, to reduce postharvest losses by 2030 and enhance the operational performance of the food supply chain. Furthermore, there is a need for other stakeholders to provide suitable training opportunities to reap the benefits of horizontal collaborative communication which will assists smallholder farmer's groups to improve their operational performance.

Keywords: Horizontal collaborative communication, information sharing, information quality, horticultural supply chain and operational performance.

Introduction

In recent years, collaboration has been realized as a strategic tool for smallholder farmers in agricultural supply chain to improve performance (Leuschner et al., 2013; Chen et al., 2017; Tarifa-Fernández et al., 2019). The practice can be done by working in relationships as a team rather than working alone (Wu et al., 2014) either internally within the organization or externally with their partner organization (Leuschner et al., 2013; Seok & Nof, 2014; Nha Trang et al., 2022). Collaboration can be achieved vertically when organizations work with suppliers or manufacturers, or horizontally when organizations work with their rivals or non-competitors in the supply chain (Seok & Nof, 2014).

[1]Lecturer, Mbeya University of Science and Technology, Tanzania.
Email: rogathherieth@gmail.com
[2]Associate Professor, University of Dar es Salaam Business School, Tanzania.
[3]Lecturer, University of Dar es Salaam Business School, Tanzania.

Collaboration practices allow farmers to improve their performance through maximum utilization of resources, increased returns, reducing market uncertainty and maximizing product consistency (Rolfe et al., 2022; Boateng et al., 2012; Zhuo & Liang, 2018). It is used to enhance greater access of information (Pereira et al., 2020) as well as increase market power of an organization (Rolfe et al., 2022). FAO (2019) identified the need to ensure efficiency in the supply chain. The performance can be attained by sharing important and quality information to strengthen their position in the supply chain (Donovan et al., 2018; Leuschner et al., 2013; Sheu et al., 2006). Leuschner et al. (2013), Cao and Zhang, (2011) and Sheu et al. (2006) identified that organizations can collaborate horizontally through collaborative communication practices by sharing important and quality information and improve their performance.

Collaborative communication as one of the collaboration practices in the supply chain was identified as a strategy to increase operational performance (Ramirez, 2020), which is typically the ability of an organization to effectively and efficiently achieve the expected performance in terms of efficiency, effectiveness, quality, flexibility, cost and reliability (Arora et al., 2016; Flynn et al., 2010). Collaborative communication refers to joint effort which involves sharing of the important and quality information among supply chain partners (Leuschner et al., 2013; Sheu et al., 2006). In collaboration relationship information was considered as the key requirement for an organization to improve their performance (Sheu et al., 2006; Zhang, 2011). According to Cao and Zhang (2011) and Sheu et al. (2006), the act of sharing important and quality information can results into operational performance improvement. Information sharing refers to the extent to which an organization shares business ideas, the demand, business knowledge and information with other organization in the same supply chain (Cao & Zhang, 2011). Information quality refers to the extent to which an organization shares a variety of relevant, accurate, complete, and in a timely manner information with its supply chain partners Sheu et al. (2006). It is also described as the key requirement in collaboration relationship (Sheu et al., 2006; Zhang, 2011).

In developing countries numerous studies have been done on the relationship between collaborative communication and operational performance considered vertical collaboration whereby an organization collaborate with their customers and suppliers in the supply chain (Jermsittiparsert et al., 2019; Shahbaz et al. 2018; Ye & Wang, 2018). For example in Indonesia, small and medium enterprises as well as manufacturing firms in Malaysia practices collaborative communication with their customers in the supply chain (Jermsittiparsert et al., 2019; Shahbaz et al. (2018)). Also manufacturing firms in China and USA considers relationship with their suppliers and customers (Zelbst et al., 2014). In previous studies, the commonly used theory in explaining the relationship between collaborative communication and operational quality is Resource Based Theory while some of the studies did not mention any theory. The Resource Based Theory was used to explain the vertical collaborative communication between suppliers and manufacturers or customers and manufacturers in which the relationship requires capital investment. Little is known on the horizontal collaborative communication when little capital investment is required to build the relationship. Using Social Exchange Theory, by Blau (1964) who defines social exchange as an exchange between two organizations that generates future expectations of return (Afshan et al., 2018). The interaction can occur between one organization and external organization in a relationship (Blau, 1964; Badraoui et al., 2020; Bae et al., 2021). Social exchange theory informs us that organizations that form relationship can acquire important

and quality information (Badraoui et al., 2020; Bae et al., 2021). The theory explains the exchange and engagement of partners and consider the outcomes of the relationship. In this regard, organizations can horizontally collaborate by sharing important and quality information to improve their operational performance (Hung et al., 2011).

Numerous studies have been conducted to examine the relationship between collaborative communication and operational performance but the findings show inconsistency and most of the studies focus on vertical collaboration of manufacturing firms and small and medium enterprises with little focus on agricultural sector. Therefore, the contribution of this research is to examine the relationship between collaborative communication and operational performance of smallholder farmers in horticultural supply chain.

Smallholder farmers were selected as unit of analysis because they dominate the agricultural sector and contribute about 75-80% of agricultural production. However, they are faced with the challenge of lack of important and quality information which affect their performance and increase operating cost as well as postharvest losses (Abdul-Rahaman & Abdulai, 2019; Tarekegn & Kelem, 2022). According to Kiaya (2014), postharvest loss is measured in terms of the quantity of food loss. Several studies identified that postharvest loss is experience by small holder farmers in downstream of the supply chain after production (FAO 2018; Tarekegn & Kelem, 2022; Baltazari et al., 2020). Msogoya and Kimaro (2011) observed high postharvest loss in developing countries than in developed countries. In Africa, the postharvest loss is estimated to be between 20% and 40% (FAO, 2018). In Ethiopia, Sisay (2022) estimated the postharvest loss to be 12.68% for non-horticultural products. In Ghana postharvest loss across dry cereals is estimated to range from 10 to 20% (MoFA, 2021) and from 10 to 41% for perishable fruits, vegetables, root, and tuber crops (Tarekegn & Kelem, 2022). In horticultural products, including fruit and vegetables, high postharvest losses (0–54%) have been reported from farm to market (MoFA, 2021). The National Postharvest Management Strategy of the United Republic of Tanzania, Ministry of Agriculture, provided that more than 40% of horticultural products are lost after harvesting in the supply chain compared to a smaller amount of other crops (URT, 2018–2027; Msogoya and Kimaro (2011). To add value to the current research, this study used Social Exchange Theory in horizontal collaboration relationship among smallholder farmers in horticultural supply chain.

Literature review

Organization practicing collaborative communication in vertical collaboration and affect their performance by reduces supply chain uncertainty and enhancing chain performance (Hashemi et al., 2022; Hung et al., 2011)**.** Organizations that practice collaborative information sharing across partners in the supply chain are more likely to integrate their internal and external value chain for better performance both within and across the supply chain (Sundram et al., 2020; Yu et al., 2015). According to Also Nguyen et al. (2022), collaborative communication has insignificant direct impact on economic performance. A study by Baihaqi and Sohal (2013) suggested that information sharing is essential but insufficient by itself to bring significant performance improvements. Studies on collaborative communication have been done considering the dimensions of operational performance include: flexibility, low cost and short cycles times (Pérez-López et al., 2019); purchasing cost, delivery quality and lead time (Jermsittiparsert et al., 2019); quality, flexibility, customer service delivery speed and cost (Shahbaz et al., 2018); cost efficiency and customer responsiveness (Ye & Wang 2018); and customer satisfaction and

productivity (Zelbst et al., 2014). Little is known on collaboration of smallholder farmers in downstream of horticultural supply chain on quality and reliability, loss, on-time delivery, productivity, cost per unit and flexibility. Studies showed inconsistency on the relationship between collaborative communication and operational performance of manufacturers (Yang et al, 2021; Zelbst et al., 2014). In horizontal collaboration, studies concentrated on collaborative communication concentrated on information sharing and performance improvement **(**Hashemi et al., 2022; Yu et al., 2022) with little focus on information quality and operational performance.

From the above empirical literature, it is observed that most of the studies concentrated on manufacturing and small and medium enterprises (Zelbst et al., 2014; Pérez-López et al., 2019; Yang et al., 2021; Ye & Wang, 2018; Shahbaz et al., 2018; Jermsittiparsert et al., 2019). It is observed that collaboration with customers has no direct relationship with operational performance, but collaboration with supplier has relationship with operational performance. Little information is known in horizontal collaboration of smallholder farmers groups in horticultural sector in developing countries. Most studies focusing on vertical collaboration (Yang et al, 2021; Pérez-López et al., 2019; Zelbst et al., 2014; Luzzini et al., 2015). Little is known on horizontal collaboration especially in collaborative communication of smallholder farmers in agricultural supply chain. In collaborative communication studies, the dimensions of operational performance were studied, Yang et al. (2021) consider collaboration with suppliers and customers in the supply chain. Pérez-López et al. (2019) consider collaboration with customers and suppliers looking at flexibility, low cost and short cycles times as dimension of operational performance. Jermsittiparsert et al. (2019) consider collaboration with customers looking at purchasing cost, delivery quality and lead time. Shahbaz et al. (2018) consider collaboration with customers looking at quality performance, flexibility performance, customer service delivery speed and cost performance. Ye and Wang (2018) consider collaboration with customers looking at cost efficiency and customer responsiveness. Zelbst et al. (2014) consider collaboration with suppliers and customers looking at customer satisfaction and productivity. There is little knowledge on the impact of information sharing on the total dimensions of operational performance in the supply chain. Looking at collaborative communication of smallholder farmers in agricultural supply chain in horizontal collaboration, the social exchange theory can be used to examine the relationship between the practice and the outcome of the practices in the supply chain. This can be done when little capital investment is needed in implementation of the relationship.

Social Exchange Theory (SET)

Blau (1964) defines social exchange as an exchange between two parties that generates future expectations of return (Afshan et al., 2018). Social exchange theory informs us that organizations form relationships can acquire needed information (Badraoui et al., 2020; Bae et al., 2021). Using social exchange theory, collaboration relationships among organizations are formed based on a cost-benefit analysis Blau (1964). An organization will choose to engage in the relationship based on what is going to get (Badraoui et al., 2020). In this case, in the relationship, an organization will exchange information and relate with other external organizations to influence their performance (Leuschner, 2013). The relationship is strengthened when the partners benefit from its outcomes (Gouldner, 1960). This theory shows the exchange process and engagement of partners in a relationship, considering return as an outcome in a relationship. In this regard, smallholder farmer groups share important and quality information and improve operational performance (Hung et al., 2011). Also, smallholder farmers commit themselves to that

engagement due to benefit obtained in that relationship (Allen & Meyer, 1990). The theory explains the exchange and engagement of partners in a relationship by considering the outcomes of the relationship.

Hypothesis development

The study employed Social Exchange Theory to examine the relationship between collaborative communication and operational performance. The theory explains the exchange process and engagement in the relationship as well as the return which is an outcome of the relationship. The groups share important and quality information to improve operational performance (Hung et al., 2011). In the relationship smallholder farmers group commit themselves to that relationship due to benefits obtained (Allen & Meyer, 1990).

Collaborative information sharing and operational performance

Collaborative information sharing has been identified as one of the major means to enhance performance (Leuschner et al., 2013). The practices allow smallholder farmers to improve their performance (Boateng et al., 2012). It is used to enhance greater access of important and quality information (Pereira et al., 2020) as well as increase market power of smallholder farmers (Rolfe et al., 2022). FAO (2019) identified the need to ensure efficiency in performance of smallholder farmers in the supply chain. The performance can be attained by effectively organizing smallholder farmers in groups to undertake joint activities by sharing important and quality information to strengthen their position in the supply chain (Donovan et al., 2018). Leuschner et al. (2013) observed that the performance in the supply chain can be improved by the organization to share important and quality information. It has been investigated in multiple industries including health and education that it collaboration relationship has a major contribution in enhancing operational performance (Abdallah et al., 2014; Effendi, 2015). Collaborative information sharing positively affects performance in many ways like enhanced service levels, customer responsiveness, decreased costs, and reduced levels of complexity (Flynn et al., 2010). Studies on collaborative communication identified that information sharing has positive significant effect on operational performance (Prodhan et al., 2022; Yu et al., 2018) and also Sheu et al. (2004) identified that increase in information quality improves performance with little information on operational performance to smallholder farmers groups. Some studies identified no significant influence (Nguyen et al., 2022; Sezen, 2008). From the contradictory results, this study will test the following hypothesis in downstream of the horticultural supply chain:

H_1: Information sharing has positive relationship with operational performance
H_2: Information quality has positive relationship with operational performance

Collaborative communication

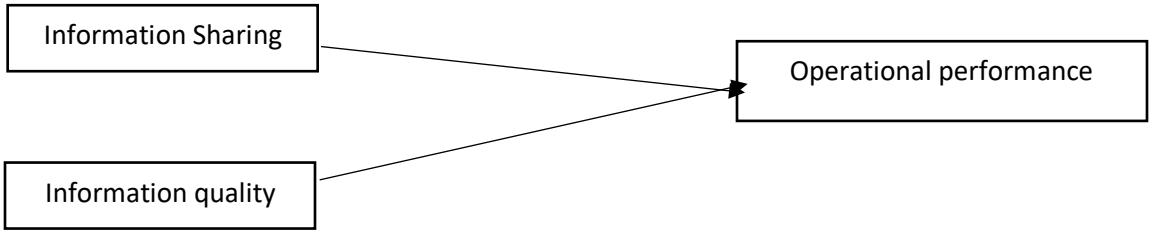

Figure1: Proposed model for collaborative communication and operational performance

Methodology and Research Design

This study used a positivist research philosophy because knowledge exists outside of what is being studied and acquired through empirical research based on measurement and observation without relying on human reasoning (Saunder, 2007). The study is cross sectional in nature with questionnaires adopted from previous research. Data were collected from horticultural smallholder farmers groups in Iringa, Mbeya, Njombe and Songwe. The selection was based on the reasons highest producing zones of fruits and vegetables, identified as the Zone of Influence (ZOI) (TAHA, 2019). The study applied survey strategy to gain the real-life setting and it is cross-sectional in nature because data was collected once at a certain point in time (Saunder, 2007). Semi-structures questionnaire e with seven-point scale was used to capture information was developed based on previously validated measures. The literature review helped to identify the valid measures of related constructs and adapt existing scales with minor modifications. Thus, the variables used in this research are developed according to the following descriptions: The measurement variable on information sharing were adapted from (Li et al., 2006; Cao & Zhang, 2011). It consists of 4 items to measure the shared information about the goods, knowledge, issues about business and any changing needs. The measurement variable on information quality were adapted from (Sheu et al., 2006). It consists of 5 items to measure the timing, accuracy, completeness, and reliable and adequate of the information shared. The measurement variables on operational performance are adapted from with minor modification (Hong et al. 2019, Shin et al. 2019 and Shou et al. 2018). This variable used 7 items to measure quality and reliability, loss, on-time delivery, Productivity, cost per unit and flexibility.

Before data collection, pilot study was conducted to 31 horticultural smallholder farmers groups in Iringa region which were excluded in the main data collection. The questionnaire were amended based on Hair's condition that the items with lower than 0.7 outer loadings should not be considered. In the study ISH1 (We inform our fellow groups on the changing needs) from the variable information sharing and IQ1(We exchange market information timely with other groups) from information quality variable were removed due to low outer loadings than the required 0.7 and its effect on the reliability, Cronbach's alpha and Average Variance Extracted (AVE). During data collection preparation, preliminary data collection was done to get the list of all the groups available in all the mentioned regions. The study identified 325 list of groups obtained from community based, agricultural and cooperative offices in which were considered. With the use of Slovin's formula a sample of 192 was considered in this study. But due to uncertainty, 210 questionnaires were administered with an excess of 18 to cover for wrong entries and incomplete information. The study obtained a response rate of 92.85% for administered questionnaires. The study employed convenience sampling technique to arrive at the respondents.

Sample statistics

Table 1 shows basics groups statistics of the survey done to 195 groups of horticultural smallholder farmers groups and identified that among members of the groups 2316 (52.4%) were male and 2100 (47.6%) were female. The highest number of members in groups their age ranges between 35-44 years 1575 (36%) followed by the age between 25-34 years 1383 (31.3%) while lowest number of members aged between 65 years and above 53 (1%). The majority of the group members have primary education 2540 (57%) followed by secondary education 1076 (24.4%) With a smaller number of members without education 183 (4.1%). In addition, more than half of

the interviewed groups have experience of working together for not more than 5 years 116 (57%) and few groups have experience of 16 years and above 8 (4.1%).

Table 1 Group information

Variable	Description	Frequency	Percentage
Gender	Male	2316	52.4%
	Female	2100	47.6%
	20-24 years	254	5.7%
	25-34 years	1383	31.3%
	35-44 years	1575	36%
	45-54 years	765	17%
	55-64years	386	9%
	65 and above	53	1%
Education	Primary education	2540	57.5%
	Secondary education	1076	24.4%
	College education	617	14%
	No education	183	4.1%
Group duration	Less than 5 years	116	59.5%
	6-10 years	46	23.6%
	11-15years	25	12.8%
	16 and above	8	4.1%

Data analysis and Results

The study used Smart-PLS software to analyze the collected data. Structural equation modeling (SME) technique was used in construct validity and reliability as well as estimation of projected hypotheses in structural model. (Hair, Hult, Ringle, & Sarstedt, 2021). Data were collected, coded in SPSS software and imported to Smart-PLS for analysis. Smart PLS was used because it is the best software in testing the relationship with lower sample size requirements (Shackman, 2013). The analysis is divided into two parts i.e. analysis of measurement model and structural model. In measurement model construct validity and reliability were observed as well as convergent and discriminant reliability. While in structural model bootstrapping was used to calculate the path coefficient to examine the developed hypotheses.

Measurement model

First, the analysis started by verifying the measurement model before structural model. The verification of the measurement model was done by confirming the factors in the measurement model using construct reliability and validity. The internal consistency method was used on to assess the reliability of the constructs using Cronbach's alpha (Hair 2010) and Composite Reliability (CR) score. According to Hair (1991), the reliability coefficient of 0.7 or higher is considered adequate, hence an alpha value of 0.7 is considered as critical value. According to Fornell et al. (1981) the recommended value of the Average Variance Extracted (AVE) for a construct should be 0.5 or above. The study results show AVE for all constructs are above 0.5 which show strong convergent validity. The study results show that Cronbach's alpha and composite reliability score for all constructs are above 0.7 which show adequate reliability of the measurement scales (Table 2) which ranged from 0.841 to 0.982, which indicate strong internal reliability. The estimated construct loadings ranged from 0.731 to 0.986 and AVE was ranged

from 0.653 to 0.810 greater than the required 0.5. This indicates that convergent validity conditions are satisfied for further analysis after 5 iterations. All the items that did not meet the condition were removed.

Table 2. Cronbach's Alpha, Composite Reliability (CR) and Average Variance Extracted (AVE)

Variables	Items	Loadings	CA	CR	AVE
Information sharing (ISH)	ISH2: We share information about the products with other groups	0.804	0.928	0.982	0.810
	IS33: We share business knowledge with other groups	0.986			
	ISH4: We share on issues that affect our business with other groups	0.901			
Information quality (IQ)	IQ2: We exchange accurate price information with other groups	0.809	0.833	0.841	0.653
	IQ23 We exchange complete/adequate demand information with other groups	0.805			
	IQ4: We exchange relevant market information with other groups	0.779			
	IQ5: We exchange reliable information on market demand with other groups	0.838			
Operational performance (OPP)	OPP1: There is an enhancement in quality performance	0.731	0.936	0.961	0.722
	OPP2: We supply reliable horticultural products	0.945			
	OPP3: There is significant decrease in postharvest loss	0.858			
	OPP4: There is an increase in good delivered on time	0.894			
	OPP5: We increase productivity gradually	0.880			
	OPP6: Our operations and process are cost effective	0.867			
	OPP7: We maintain flexibility in meeting orders in the market	0.753			

In discriminant validity square root of AVE and cross loading matrix are used. To ensure satisfactory discriminant vilify Boyd et al. (2013) pointed out that, the square root of AVE of a construct should be greater than that of its correlation. Also, it is provided that the diagonal values of a construct must be greater than the values in corresponding columns and rows to satisfy the condition of discriminant validity (Henseler & Sarstedt, 2013). In this study Fornell –Larcker Criterion was used to assess the condition (see table 3). The results from the Table 3 show that all constructs support discriminant validity by having diagonal values of the constructs greater than their corresponding rows and columns.

Table 3. Discriminant validity- Fornell –Larcker Criterion(Correlation matrix and AVE square root)

	IQ	ISH	OPP
Information Quality (IQ)	**0.809**		
Information Sharing (ISH)	0.719	**0.912**	
Operational performance (OPP)	0.239	0.287	**0.843**
The diagonal presents square root of average variance extracted (AVE) and off-diagonal values represents the correlation between constructs information quality (IQ), information sharing (IS) and Operational performance (OPP)			

Structural model for horizontal collaborative communication and operational performance
Path analysis in PLS- bootstrapping was used to assess the relationship between horizontal collaborative communication and operation performance. Hypotheses were tested using the condition that t-statistics should be greater than 1.96.

Table 4: Path Coefficient, R Square, T statistics and P-value

Hypotheses	Path coefficient	R square	T-statistics	P values	Decision
H1: IQ -> OPP	0.843	0.826	16.352	0.000	Supported
H2: ISH -> OPP	0.244	0.826	2.657	0.008	Supported
Significant at P < 0.05 IQ= Information quality, ISH = Information sharing and OPP= Operational performance					

The result indicates that R^2 value of operational performance is 0.884 which indicates that 88.4% of the variation of the operational performance in the model is explained by independent variables used in the model. Structural equation model was used to test hypotheses by assessing the relationship between variables and the values of standard error, t-statistics and p-value were established. Table 4 above shows the relationship between IQ and OPP ($t = 16.352$, $\beta = 0.843$, $P < 0.05$) and ISH and OPP ($t = 2.657$, $\beta = 0.244$, $P < 0.05$) to be significant. Therefore, H1 and H2 were supported.

Discussion of results
The relationship between information sharing and operational performance is significant at 0.005 level $\beta = 0.244$, $t = 2.657$, and $p = 0.008$ and also, the relationship between information quality and operational performance is significant at 0.05 level, $\beta = 0.843$, $t=16.352$ and $p < 0.001$. The study found that collaborative communication information quality and information sharing lead to operational performance. The results resemble with Prodhan et al. (2022) who studied fishing industry in Bangladesh. Similarly, Yu et al. (2018) who studied food companies in China found out that information sharing has positive and significant effect on operational performance. On the other side Sheu et al. (2004) identified the influence of information quality on performance. Contrary to that Nguyen et al. (2022) identified insignificant effect of information sharing on performance, Similarly, Baihaqi and Sohal (2013), provided that information sharing is essential but insufficient by itself to bring significant performance improvements. Sezen (2008) also identified that information sharing in manufacturing sector in Turkey has no significant positive effect on operational performance.

Recommendations and policy implications

Findings show that social exchange of important and quality information in horizontal collaboration relationship which does not involve large capital investment leads to performance improvement. Findings provide that, there is a positive relationship between information sharing as well as information quality and operational performance. This is practically the theoretical contribution on collaborative communication and operational performance literature. The study provides the ground for implementation of agricultural sector considering smallholder farmers. The results will widen knowledge and understanding of the variables in horizontal collaborative communication and their effects on operational performance. The government and policymakers are advised to formulate policies in the agricultural domain on horizontal collaborative communication that contributes to the achievement of Sustainable Development Goal (SDG) Number 17 as well as to align with the strategic objectives outlined by the Food and Agriculture Organisation (FAO) in 2018, to reduce postharvest losses by 2030 and enhance the operational performance of the food supply chain. Furthermore, there is a need for other stakeholders to provide suitable training opportunities to reap the benefits of horizontal collaborative communication which will assists smallholder farmer's groups to improve their operational performance.

References

Abdallah, B., Irani, J., Sailian, S. D., Gebran, V. G., & Rizk, U. (2014). Nursing faculty teaching a module in clinical skills to medical students: a Lebanese experience. *Advances in Medical Education.*

Abdul-Rahaman, A. (2019). *Coordination and Impact of Agrifood Value Chains on Farm Performance: Evidence from Smallholder Rice Farmers in Northern Ghana* (Doctoral dissertation, Christian- Albrechts Universität Kiel). *Practice*, 427-432.

Afshan, N., Chatterjee, S., & Chhetri, P. (2018). Impact of information technology and relational aspect on supply chain collaboration leading to financial performance: A study in Indian context. *Benchmarking: An International Journal*, *25*(7), 2496-2511.

Badraoui, I., Van der Vorst, J. G., & Boulaksil, Y. (2020). Horizontal logistics collaboration: an exploratory study in Morocco's agri-food supply chains. *International Journal of Logistics research and applications*, *23*(1), 85-102.

Bae (2017) Empirical Relationships of Perceived Environmental Uncertainty, Supply Chain Collaboration and Operational Performance: Analyses of Direct, Indirect and Total Effect

Baihaqi, I., & Sohal, A. S. (2013). The impact of information sharing in supply chains on organisational performance: An empirical study. *Production Planning and Control*, *24*(8–9), 743–758. https://doi.org/10.1080/09537287.2012.666865

Baltazari, A., Mtui, H., Chove, L., Msogoya, T., Kudra, A., Tryphone, G., & Mwatawala, M. (2020). Evaluation of post-harvest losses and shelf life of fresh mango (Mangifera indica L.) in Eastern zone of Tanzania. *International Journal of Fruit Science*, *20*(4), 855-870.

Blau, P. (1964). *Exchange and power in social life*. New York: Wiley.

Boateng, M., Okai, D. B., Salifu, A. R. S., & Ewool, M. B. (2012). A comparative study of two normal maize and two Quality Protein Maize varieties–Effects on growth performance and carcass characteristics of albino rats. *J. Anim. Sci. Adv*, *2*(9), 787-792.

Boyd, B. K., Bergh, D. D., Ireland, R. D., & Ketchen Jr, D. J. (2013). Constructs in strategic management. *Organizational Research Methods, 16*(1), 3-14.

Cao, M., & Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of operations management*, *29*(3), 163-180.

Chen, L., Zhao, X., Tang, O., Price, L., Zhang, S., & Zhu, W. (2017). Supply chain collaboration for sustainability: A literature review and future research agenda. *Intern. Journal of Production Economics*, *March*, 1–15. https://doi.org/10.1016/j.ijpe.2017.04.005

Effendi, M. S. (2015). Improving Teacher Professionalism Trough Lesson Study. *Ahmad Dahlan Journal of English Studies*, *2*(3), 23-30.

FAO. 2018 *How to Feed the World in 2015*; FAO: Rome, Italy, 2009; Available online: http://www.fao.org/fileadmin/templates/ (accessed on 10 April 2018).

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics.

Gouldner, A. W. (1960). The norm of reciprocity. American Sociological Review, 25, 165-167.

Hair Jr, J. F., Babin, B. J., & Anderson, R. E. (2010). A global perspective. *Kennesaw: Kennesaw State University*.

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). A primer on partial least squares structural equation modeling (PLS-SEM). Sage publications.

Hair, J.R., Ringle C.M., & Sarstedt M. (2011) PLS-SEM: Indeed, a Silver Bullet, *Journal of Marketing Theory and Practice*, 19:2, 139-152, DOI: 10.2753/ MTP1069-6679190202

Hashemi, S. M., Handayanto, E., Masudin, I., Zulfikarijah, F., & Jihadi, M. (2022). The effect of supply chain integration, management commitment and supply chain challenges on non-profit organizations performance: Empirical evidence from Afghanistan. *Cogent Business and Management*, *9*(1). https://doi.org/10.1080/23311975.2022.2143008

Henseler, J., & Sarstedt, M. (2013). Goodness-of-fit indices for partial least squares path modeling. Computational statistics, 28(2), 565-580

Hong, J., Zheng, R., Deng, H., & Zhou, Y. (2019). Green supply chain collaborative innovation, absorptive capacity and innovation performance: Evidence from China. *Journal of Cleaner Production*, *241*, 118377.

Hung, W. H., Ho, C. F., Jou, J. J., & Tai, Y. M. (2011). Sharing information strategically in a supply chain: Antecedents, content and impact. *International Journal of Logistics Research and Applications*, *14*(2), 111–133. https://doi.org/10.1080/13675567.2011.572871.

Jermsittiparsert, K., & Rungsrisawat, S. (2019). The supply chain management and information sharing as antecedents of operational performance: A case of SMEs. *Humanities & Social Sciences Reviews,* 7(2), 495-502.

Kiaya, V. 2014. Post-harvest losses and strategies to reduce them. Technical Paper on Post harvest Losses, Action Contre la Faim (ACF). p. 25.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and psychological measurement, 30(3), 607-610.

Leuschner, R., Rogers, D. S., & Charvet, F. F. (2013). A Meta-Analysis of Supply Chain Integration and Firm Performance. *Journal of Supply Chain Management*, *49*(2), 34–57. https://doi.org/10.1111/jscm.12013

Luzzini, D., Brandon-Jones, E., Brandon-Jones, A., & Spina, G. (2015). From sustainability commitment to performance: The role of intra-and inter-firm collaborative capabilities in the upstream supply chain. *International Journal of Production Economics*, 165, 51-63

MoFA. Investing for Food and Jobs (IFJ): An Agenda for Transforming Ghana's Agriculture (2018-2021). P.30, 2020.

Msogoya, T.J., & Kimaro, E.S. (2011). Assessment and management of post harvest losses of fresh mango under small-scale business in Morogoro. *Tanzania. J. Anim. Plant Sci*, *11*(1), 1358-1363.

Nguyen, M. H., Phan, A. C., & Matsui, Y. (2022). Supply chain integration and economic performance: Empirical evidence from a developing country. *Benchmarking: An International Journal*, *29*(9), 2710–2732. https://doi.org/10.1108/BIJ-01-2021-0004

Nha Trang, N. T., Nguyen, T.-T., Pham, H. V., Anh Cao, T. T., Trinh Thi, T. H., & Shahreki, J. (2022). Impacts of Collaborative Partnership on the Performance of Cold Supply Chains of Agriculture and Foods: Literature Review. *Sustainability*, *14*(11), 6462. https://doi.org/10.3390/su1411646

Pérez-López, R. J., Olguin Tiznado, J. E., Mojarro Magaña, M., Camargo Wilson, C., Lopez Barreras, J.& García-Alcaraz, J. L. (2019). Information sharing with ICT in production systems and operational performance. *Sustainability,* 11(13), 3640

Ramirez, M. J., Roman, I. E., Ramos, E., & Patrucco, A. S. (2021). The value of supply chain integration in the Latin American agri-food industry: trust, commitment and performance outcomes. *The International Journal of Logistics Management*, *32*(1), 281-301.

Rolfe, J., Akbar, D., Rahman, A., & Rajapaksa, D. (2022). Journal of Co-operative Organization and Management Can cooperative business models solve horizontal and vertical coordination challenges? A case study in the Australian pineapple industry. *Journal of Co-Operative Organization and Management*, *10*(2), 100184. https://doi.org/10.1016/j.jcom.2022.100184

Seok, H., & Nof, S. Y. (2014). Collaborative capacity sharing among manufacturers on the same supply network horizontal layer for sustainable and balanced returns. *International Journal of Production Research*, *52*(6), 1622-1643.

Sezen, B. (2008). Relative effects of design, integration and information sharing on supply chain performance. *Supply chain management: An international journal*, *13*(3), 233-240.

Shackman, J. D. (2013). The use of partial least squares path modeling and generalized structured component analysis in international business research: A literature review. International Journal of Management, 30(3), 78.

Shahbaz, M. S., Rasi, R. Z. R., Ahmad, M. B., & Sohu, S. (2018). The impact of supply chain collaboration on operational performance: Empirical evidence from manufacturing of Malaysia. *International Journal of Advanced and Applied Sciences*, 5(8), 64-71.

Sheu, C., Rebecca Yen, H., & Chae, B. (2006). Determinants of supplier-retailer collaboration: evidence from an international study. *International Journal of Operations & Production Management*, *26*(1), 24-49.

Shin, N., Park, S. H., & Park, S. (2019). Partnership-based supply chain collaboration: Impact on commitment, innovation, and firm performance. *Sustainability*, *11*(2), 449.

Sisay, D., Damtie, G., & Wendimu, A. (2022). Post-harvest losses of Malt Barley at the farm level in Debark district, North Gondar zone, Amhara region, Ethiopia. *International Journal of Agricultural Sustainability*, *20*(7), 1249-1259.

Sundram, V. P. K., Chhetri, P., & Bahrin, A. S. (2020). The consequences of information technology, information sharing and supply chain integration, towards supply chain performance and firm performance. *Journal of International Logistics and Trade*, *18*(1), 15-31.

Tarekegn K. & Kelem F. (2022) Assessment of Mango Post-Harvest Losses along Value Chain in the Gamo Zone, Southern Ethiopia, *International Journal of Fruit Science*, 22:1, 170-182, doi: 10.1080/15538362.2021.2025194

Tarifa-Fernández, J., de-Burgos-Jimenez, J., & Cespedes-Lorente, J. (2019). Absorptive capacity as a confounder of the process of supply chain integration. *Business Process Management Journal*, *25*(7), 1587–1611. https://doi.org/10.1108/BPMJ-12-2017-0340

Uddin, M. B. (2022). The effect of strategic commitment and supply chain collaboration on operational and innovation performance. *IIMB Management Review,* 34(4), 364-377.

URT, (2018 -2027) https//www. knowledgecenter.amdt.co.tz/national-post-harvest-management Strategy.

Wang, Z., Li, L., Liu, Y., Jiang, Y., Wang, Y., & Dai, Y. (2024). An experimental study on mixed reality-based user interface for collaborative operation of high-precision process equipment. *The International Journal of Advanced Manufacturing Technology*, *132*(5), 2443-2459.

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

Yang, Z., Xiang, W., You, W., & Sun, L. (2021). The influence of distributed collaboration in design processes: an analysis of design activity on information, problem, and solution. *International Journal of Technology and Design Education*, *31*, 587-609.

Yu, X., Cui, Y., Chen, Y., Chang, I. S., & Wu, J. (2022). The drivers of collaborative innovation of the comprehensive utilization technologies of coal fly ash in China: A network analysis. *Environmental Science and Pollution Research*, *29*(37), 56291-56308.

Zhang, Y., Sun, J., Yang, Z., & Wang, Y. (2018). Mobile social media in inter-organizationa projects: Aligning tool, task and team for virtual collaboration effectiveness. *International Journal of Project Management*, *36*(8), 1096-1108.

Zelbst, P., W. Green, Jr, K., E. Sower, V., & D. Abshire, R. (2014). Impact of RFID and \ information sharing on JIT, TQM and operational performance. Management Research Review, 37(11), 970-989. https://www.tanzaniainvest.com/smallholders and follow us on www.twitter.com/tanzaniainvest