Effect of information sharing in supply chains: understanding the roles of supply chain visibility, agility, collaboration on supply chain performance

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Charles Baah
Transportation Engineering College, Dalian Maritime University, Dalian, China
Douglas Opoku Agyeman
Department of Marketing and Entrepreneurship, University of Ghana, Accra, Ghana
Innocent Senyo Kwasi Acquah
Department of Marketing and Supply Chain Management, University of Cape Coast, Cape Coast, Ghana
Yaw Agyabeng-Mensah and Ebenezer Afum
Transportation Engineering College, Dalian Maritime University, Dalian, China
Kassimu Issau and Daniel Ofori
Department of Marketing and Supply Chain Management, University of Cape Coast, Cape Coast, Ghana, and
Daniel Faibil
Faculty of Management and Economics, Dalian University of Technology, Dalian, China

Abstract

Purpose – Exploring ways to acquire, sustain and improve competitive positions in supply chains through information sharing, supply chain visibility, collaboration and agility have been essential for scholars and practitioners. Basing on the relational view, resource based view and the extended resource based view, this study assesses the critical role of information sharing in supply chains through emphasizing its effect on supply chain visibility, collaboration, agility and supply chain performance. Particularly, the study proposes that information sharing, supply chain visibility, collaboration and agility collectively have crucial direct and indirect influences on supply chain performance which lead to superior gains, competitiveness and flexibility.

Design/methodology/approach – The study adopted a survey research design, a quantitative approach and partial least square structural equation modeling (PLS-SEM) in making data analysis and interpretations due to its suitability for predictive research models.

Findings – The results indicate information sharing positively and significantly influenced supply chain visibility, collaboration, agility and performance. Supply chain visibility presented significant effects on collaboration, agility and performance, while supply chain collaboration and agility had significant impact on supply chain performance. The study findings connote that information sharing is key to enhancing competitive gains and superior supply chain performance.

Originality/value – The study is among the few to probe on how information sharing as a variable interacts with supply chain visibility, collaboration, agility and performance. Although, information sharing has received a lot of attention in supply chains, this study is among the first to capture the study variables in a single model and thus, exposes the vital need for information sharing in improving supply chain performance seeing that it ensured significant and robust impacts on the study variables.

Keywords Information sharing, Supply chain visibility, Supply chain collaboration, Supply chain agility, Supply chain performance, PLS-SEM

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1. Introduction

In recent times, competition on the basis of supply chains has attracted significant attention especially in relation to facing uncertainties in business environments. Accordingly, scientific contributions on supply chains have projected the critical role of information sharing which forms the basis of supply chain visibility, collaborations and agility (Cao and Zhang, 2011; Abdallah *et al.*, 2017; Mor *et al.*, 2018; Routroy *et al.*, 2018). Thus, in a firm's quest to survive and achieve competitive advantages, there is the vital need to create and share or disseminate information that is relevant, timely and up-to-date. A firm's ability to ensure the acquisition and sharing of such information across its supply chain according to several scholars will experience enhanced supply chain collaborations, visibility, agility, competitive/collaborative advantage and supply chain performance (Nyaga *et al.*, 2010; Mishra *et al.*, 2018; Routroy *et al.*, 2018). Despite the attention given to information sharing as a critical antecedent to supply chain visibility (Mor *et al.*, 2018), collaboration (Cao and Zhang, 2011), agility (Brusset, 2016) and performance (Sezen, 2008; Prakash *et al.*, 2017), few studies have observed the interactions between these variables in a single model thus creating the need for further probe to establish the robust influence of information sharing as well as observe the direct and indirect effects among these variables.

Consistent with the indicated premise, information sharing according to Colicchia *et al.* (2018) is the glue that holds supply chains together especially with regards to supply chain partners. Singh *et al.* (2020) further indicated that miscommunications, which result from poor information sharing, creates conflicts and misunderstandings in supply chains, which defeat the overall goal of superior performance. Cao and Zhang (2011) recommended that information sharing is a critical component of supply chain collaborations and as such, collaborations between supply chain partners can be based on leveraging information sharing to acquire competitive advantage. A significant amount of research has focused on supply chain visibility and how it enhances supply chain practices leading to superior competitive positions (Barrat and Oke, 2007; Williams *et al.*, 2013; Caridi *et al.*, 2014; Singh *et al.*, 2019). Although in these past researches, information sharing was dominant in the explanation of key visibility, collaboration and agility concepts, this is among the few studies that captures information sharing as a variable seeking to establish effects on supply chain visibility, collaboration, agility and performance. According to Prakash *et al.* (2017), firms are now focusing on supply chains and therefore are adopting ways that improve supply chain connections since a supply chain stays connected by sharing of information, finance and materials by suppliers, producers, retailers, distributors and customers. The author further highlighted that the important value of sharing information within a supply chain relates to how the benefits outweighs the costs involved.

Furthermore, in the scrutiny of supply chain visibility, collaboration and agility, the existing literature has ignored the indirect effects these variables have in ensuring enhanced supply chain performance. Supply chain visibility according to Kumar and Singh (2017) had initial definitions centered on the ability to access and share information across supply chains and using this information in real time. Barrat and Oke (2007) further indicated that supply chain visibility relies on sharing not just any information but information that is deemed accurate, trusted, timely, useful and useable in supply chains. This definition as captured by Barrat and Oke (2007) suggests that supply chain visibility also plays important role in enhancing supply chain collaborations, agility and performance. This is because supply chain visibility will build the trust of supply chain partners leading to improved collaborations and agility, which ends up improving supply chain performance. Supply chain collaborations as reflected by Cao and Zhang (2011) is a very important component in achieving collaborative advantage. The authors further reflect the relevance of collaborations among supply chain partners by connoting that collaborative initiatives among supply chain partners promote cost reduction, risk sharing, complementary assets, rapid learning, among others. The authors also agreed with

Feizabadi *et al.* (2019) and Kumar Singh and Modgil (2020) in asserting that supply chain collaborations enables a firm to build speed, which helps to quickly take advantage of market opportunities, introduce new products, solve problems, among others hence reducing market risks associated with market volatility, thus, building on the concept of supply chain agility.

Supply chain agility according to Gligor *et al.* (2013) have received great attention over the past decade. However, there exists no universally accepted definition for the concept. Gligor *et al.* (2013) thus proceeded to give their definition as "a firm's ability to quickly adjust tactics and operations within its supply chain to respond or adapt to changes, opportunities, or threats in its environment." Brusset (2016) also indicated the fundamentals of supply chain agility as being able to swiftly respond to market changes in addition to exploiting opportunities whiles dealing with threats through market sensitivity, information sharing, network-based flexibility and process integration. Currently, supply chain managers are under pressure to instill agility in supply chains to match the speed of change and the accelerating competition in markets (Choudhary and Sangwan, 2018). This shows how relevant supply chain agility is when it comes to ensuring sustained supply chain performance. Nonetheless, ensuring sustained or improved supply chain performance is very vital in current business environments where competition has shifted from firms to supply chains (Sezen, 2008; Abdallah *et al.*, 2017). From the above brief explanation of the supply chain visibility, collaboration and agility concepts, it is evident that for these concepts to be operationalized effectively to improve supply chain performance, information sharing is very vital. Thus, this study focuses on the effects of information sharing in interacting with supply chain visibility, collaboration, agility and performance. The study further highlights on the direct and indirect effects of information sharing, supply chain visibility, collaboration and agility in influencing supply chain performance.

Moreover, the study after establishing directs effects among variables will also seek to establish indirect effects among variables to enhance knowledge and practice. Again, the study was centered on manufacturing firms due to how such firms and industries are dependent on supply chains to enhance superior overall firm performance. The small and medium-sized enterprises' (SMEs) nature of most firms operational in the Ghanaian manufacturing sector also influences the nature of the study in that most of these firms have supply chains that lack key resources such as information technology investments among others. However, it is worth mentioning that the absence of these resources does not critically impact supply chains due to their supply chains being less complex as compared to non-SMEs. This indicate that due to the less complex nature of SMEs supply chains, more attention can be given to supply chain partners in addition to other collaborative investments to boost supply chain performance.

From the above discussions, the study develops and seeks to respond to the following research questions; (a) how do information sharing, supply chain visibility, supply chain collaboration, supply chain agility and supply chain performance interact in a single model, (b) how does information sharing directly influences supply chain visibility, supply chain collaboration, supply chain agility and supply chain performance and (c) how do supply chain visibility, supply chain collaboration, supply chain agility indirectly influence supply chain performance. The next section describes the review of literature and hypothesis development before exposing the research methodology in Section 3. Section 4 reports analysis of data and discussions while Section 5 captures conclusions, implications for theory and practice and limitations and suggestions for future research.

2. Literature review

2.1 Theoretical paradigms

Over the years, the need to strategically position supply chains to be able to gain better outcomes have been key for managers and academics (Dubey *et al.*, 2018; Baah and Jin, 2019;

Baah *et al.*, 2020a, b, 2021b). This contributes to the reasons why current competition arenas' captures supply chains other than individual firms. The relational view which was proposed by Dyer and Singh (1998) posits that critical resources span across firm borders and as such, supply chain collaborations should be enhanced to enjoy supernormal profits. Dubey *et al.* (2020) further explained that supernormal profits come in the form of rents that cannot be generated by individual firms. Thus, the authors recommended the need for firms to create collaborative alliances so as to create not only internal rents but also relational rents. Dubey *et al.* (2020) in agreement with Feizabadi *et al.* (2019) suggested that relational rents are possible when collaborating partners combine and exchanges knowledge, assets and capabilities through joint investments, inter-firm knowledge sharing initiatives, complementing resources, effective governance mechanisms, among others. Thus, the relational view posits that collaborations in supply chains enable joint value creation, which would have been impossible on individual firm basis and also projects gains for mutual benefits.

This relational view was further supplemented by the resource based view by giving a detailed perspective on collaborative efforts in supply chains and how they accrue diverse and important benefits for partners (Cao and Zhang, 2011; Barney, 2012; Yang *et al.*, 2019). The resource based view connotes that differences in firm outputs can be explained by differences in strategic resources, capabilities and assets. Most importantly, core competence, dynamic capabilities and absorptive capacity of firms precede all from the resource based view perspective in that firms that are able to master these in addition to unique combination of resources will achieve greater advantages than competing firms (Cao and Zhang, 2011; Collins, 2021). Barney (2012) further highlighted that firms that excel in core competencies and capabilities in addition to owning strategic resources will likely see greater outputs. Practically, the resource based view explains that companies that form collaborations and other forms of alliances that go to the core of joint assets investments can lead to building competitive advantages due to the rare, valuable, non-imitable and non-substitutable nature (Barney, 2012). Past studies basing on the resource based view explain dynamic capabilities as the capacity of managers and other workers to affect and adjust resource allocations thereby bringing in play new organizational thoughts (Aslam *et al.*, 2018; Dubey *et al.*, 2020). The absorptive capacity as mentioned by Dyer and Singh (1998) and Cao and Zhang (2011) revolves around a firm's ability to assimilate and use vital information or knowledge to improve specific firm skills in achieving economies of scale mostly through the learning effect. Thus, the resource based view being complementary to the relational view projects supply chain visibility, agility and collaborations to improving supply chain performance.

Furthermore, the study highlights the extended resource based view which posits that firms enjoy or achieves advantages on the basis of ability to access resources and use resources or enjoy resource associated benefits (Cao and Zhang, 2011; Collins, 2021). Again inter-connected firms as espoused by Collins (2021) form dyadic collaborations or alliances that integrate both external and internal resources to achieve competitive advantages. According to Collins (2021), these competitive advantages that accrue to firms in dyadic collaborations or alliances can be categorized into four key elements namely; internal rents which is benefits derived from the focal firms shared and non-shared resources, appropriated relational rent which captures benefits only derived from shared resources of partners, inbound spillover rent which is benefits extracted from partners shared and non-shared resources by reason of knowledge leakages and inter-firm learning and outbound spillover rent which is benefits derived from the transfer of benefits from focal firm to partners. These benefit categorizations exist for mutual benefits of supply chain partners and as such, lead to better performance of supply chains and its components since an effective and efficient supply chain collaborations rely on information sharing, visibility in supply chains leading to supply chain agility and performance.

Based on the relational view, resource based view and the extended resource based view, this study highlights that information sharing is critical for improved and sustained supply chain performance, collaborative advantage and competitiveness (Holcomb *et al.*, 2011; Cao and Zhang, 2011; Feizabadi *et al.*, 2019; Collins, 2021). Despite the critical role of information sharing, few studies have aimed to elaborate on how it boosts supply chain visibility, supply chain collaboration, supply chain agility and supply chain performance in the context of an emerging economy and from the perspectives of SMEs. This study specifically seeks to contribute to the literature by exposing how information sharing directly affects SMEs supply chain visibility, supply chain collaboration, supply chain agility and supply chain performance. In addition, the study further exposes the indirect roles of supply chain visibility, supply chain collaboration and supply chain agility on supply chain performance (Prakash *et al.*, 2017; Baah *et al.*, 2021a; Singh *et al.*, 2021a). This study is relevant in that it contributes to knowledge on information sharing, supply chain visibility, supply chain collaboration, supply chain agility, supply chain performance and how these variables interact directly and indirectly.

2.2 Conceptual development

Supply chain performance would likely stand higher chances of sustained or superior performance though the sharing of vital, timely, useful and up-to-date information which leads to improved supply chain visibility, collaborations and agility (Cao and Zhang, 2011; Caridi *et al.*, 2014; Brusset, 2016). Barrat (2004) also indicated that by collaborative efforts in supply chains, partners are motivated to work together as a single unit thus, allowing access to each other's resources leading to mutual benefits and advantages. These collaborations in supply chains definitely have a bearing (improved effect) on supply chain performance as well as the other variables captured in the study namely; information sharing, supply chain visibility, collaboration and agility. These direct and indirect interactions among adopted study variables are captured in Figure 1 briefly explained below are the study variables.

Information sharing has received great attention especially in supply chains due to how critical it is to crafting strategic supply chain responses (Colicchia *et al.*, 2018; Yang *et al.*, 2019). According to Colicchia *et al.* (2018), firms are investing seriously in information technologies due to the need for adaptability in respond quickly to market changes. For firms to be fast in responding to market changes, firms must have knowledge of new and useful information generated in the environment and adopt strategies in making fast decisions based on this new information (Colicchia *et al.*, 2018; Yang *et al.*, 2019). More critically,

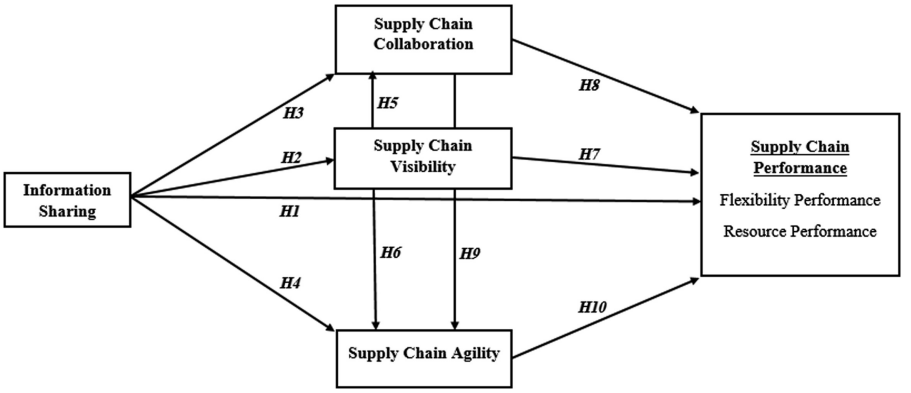

Figure 1.
Conceptual model showing hypotheses

information sharing allows firms and supply chains adapt to the evolving nature and dynamics of current competitive markets (Fawcett *et al.*, 2009; Feizabadi *et al.*, 2019). Zhou and Benton (2007) also elaborated that information sharing should be assessed on the basis of content and quality. Thus, the authors established that for information shared to be relevant or vital for supply chains competitiveness, the information should have quality and good content as supported by Dubey *et al.* (2018). Barrat and Oke (2007) further indicated that investments in information technologies such as enterprise resource planning, electronic data interchange and the Internet are very necessary if firms and their supply chains aim for competitiveness.

Supply chain visibility has been deemed vital for collaborations and improved performance in supply chains (Barrat and Oke, 2007; Caridi *et al.*, 2014). Sharing of meaningful and timely information in supply chains lead to visibility in supply especially for focal firms (Barrat and Oke, 2007). For focal firms, information sharing enables visibility both internally and externally, which further helps in building lasting and strong relationships with diverse stakeholders (Holcomb *et al.*, 2011). This happens because visibility breeds collaborations and trust in relationships with partners and as such, enables the development of strong relationships with partners and stakeholders. Holcomb *et al.* (2011) again indicated the relevance of visibility in supply chains by asserting that visibility enhances connectivity which proves key in handling uncertainty issues since visibility based on the right information promotes faster responses to market dynamics.

Supply chain collaboration has been presented as one of the best sources of gaining competitive prowess by Cao and Zhang (2011). The authors indicated that the right collaborations in supply chains centered on information sharing, goal congruence, resource sharing and collaborative communication among others significantly influence performance outcomes in supply chains. Dubey *et al.* (2018) further projected that in this competitive era units in supply chains should collaborate as well as supply chain partners to stay competitive. The fundamental of supply chain collaboration has been captured by Jimenez-Jimenez *et al.* (2018) by defining it as "two or more autonomous firms working together to plan and implement supply chain operations". From this underlying definition, it is evident that working together with supply chain units and partners as a single entity boosts inter-firm learning, knowledge creation, leveraging of assets jointly among others. This view has been used by companies such as Dell, IBM, Walmart and others to reduce risks, costs and achieve stronger competitive positions in their respective sectors (Cao and Zhang, 2011; Jimenez-Jimenez *et al.*, 2018). This indicates the relevant and critical nature of supply chain collaborations in today's quest to achieve sustained competitive advantage.

Supply chain agility as indicated by Gligor *et al.* (2013) has received great attention. This attention or focus indicates its relevance to enhancing performance. Supply chain agility bases on information sharing, supply chain visibility as well as collaboration for it to achieve its aim of enhancing faster responses or adaptation to market changes (Brusset, 2016). According to the author, supply chain agility presents important notes on dealing with issues of uncertainties and risk thus, requires key attention and focus in this era of diverse uncertainties as indicated by Gligor *et al.* (2013). According to Brusset (2016), Zara's performance overtime with regards to how the ability to overcome challenges related to fast changes in the fashion industry makes the firm legendary in terms of agility. Current competitive trends require managers and supply chain partners to optimize services and reduce costs. The ability to maximize services in this regard requires fast adaptations to customer demands and preferences which emphasizes the need for agility in supply chains. Supply chain agility as espoused by Brusset (2016) helps firms follow customers' preferences in addition to providing improved current products or new products at the right time at the right price. The author further indicated market sensitivity, shared information, network-based flexibility and process integration as key pillars of supply chain agility and as such,

managers should place emphasis on enhancing these components to improve supply chain agility.

Supply chain performance have been viewed from the perspectives of measuring supply chain performance and establishing predictors influences and how they explain why some supply chains operate efficiently and better than others. Furthermore, managing and measuring supply chain performance is critical for creating value and gaining competitive advantage amidst this recent competitive environment (Sezen, 2008; Blome *et al.*, 2013; Dubey *et al.*, 2018). Past studies have centered on cost, customer responsiveness and activity time in measuring supply chain performance (Arntzen *et al.*, 1995; Pyke and Cohen, 1994). Due to the easy to compute and quantitative nature of cost, most of these studies adopted cost in assessing supply chain performance. This practice of using such simple methods in assessing performance in supply chains according to Sezen (2008) is limited in scope. As such, the author developed a framework for choosing measures for supply chain performance. On the basis of this developed framework, two types of performance measures were noted as vital in assessing supply chain performance in the context of the study namely: flexibility and resource outcomes. These were chosen by reason of how they to a greater extent relate with the predictor variables adopted in the study. For instance, agility in supply chains is expected to have a bearing on flexibility in supply chains, which also improves supply chain performance. Additionally, information sharing, visibility and collaborations in supply chains lead to the combination of key resources that lead to improved advantages, joint-knowledge creation and acquisition of relational rents, which are impossible to achieve by the single firm and ultimately lead to improved supply chain performance. Figure 1 shows the conceptual framework and hypothesized relationships.

2.3 Hypothesis development

2.3.1 The relationships between supply chain visibility, collaboration, agility, performance and information sharing. Information sharing as explained in the literature review forms a vital component in enhancing supply chain visibility, collaboration, agility and performance (Barrat and Oke, 2007; Sezen, 2008; Cao and Zhang, 2011; Blome *et al.*, 2013; Eckstein *et al.*, 2015; Brusset, 2016). These past studies indicate that information sharing allows supply chain partners to efficiently and effectively work as a single unit in responding to customer needs, market changes and competitive demands. Due to current competitive markets, stressing on information sharing as a critical weapon in gaining competitive advantages due to how it promotes long-term cooperation and coordination, which leads to improved supply chain and firm performances cannot be overemphasized (Lofti *et al.*, 2013; Aslam *et al.*, 2018). Thus, the need to create, share and use relevant information is key to attaining improved supply chain performance in current business environments. The authors further asserted that the important role of information sharing in supply chains is that it enhances benefits while reducing costs such as initial information systems investment (e.g. electronic data interchange, enterprise resource planning, etc.). Dubey *et al.* (2020) explained that as competition deepens, information technology and processing also evolves and as such, firms have the responsibility of becoming integrated to be able to achieve agility and competitive gains while improving supply chain performance. Additionally, Aslam *et al.* (2018) emphasized that effective information sharing practices in supply chains is crucial for developing dynamic capabilities which enhances supply chain practices and performance. Dubey *et al.* (2018) in harmony with Cao and Zhang (2011) espoused that information sharing project collaborative and competitive advantages through effective supply chain collaborations, agility, adaptability and alignment. Supply chain visibility and agility has mostly been associated with information sharing as indicated by Barrat and Oke (2007) and Brusset (2016). According to Brusset (2016) supply chain agility is mostly dependent on market sensitivity and the ability to identify and access information, which was captured as

virtual in their study. Moreover, visibility in supply chains as captured by Blome *et al.* (2013) requires information sharing to achieve its objectives. Thus, information sharing in supply chains improves visibility which also improves collaborations, agility and ultimately performance (Blome *et al.*, 2013; Dubey *et al.*, 2018, 2020). Moreover, information sharing boosts collaborations in supply chains which also significantly impacts competitive advantage as detailed by Feizabadi *et al.* (2019). Cao and Zhang (2011) established how supply chain collaborations based on effective information sharing improves relational rents in addition to others leading to elevated competitive positions obtained from collaborative advantage and improve firm performance. From the above, it is without question that information sharing disperses enormous benefits in supply chains from visibility to performance and as such needs further probing to expand knowledge on the wider scope and impact of information sharing in supply chains. Thus, we propose the hypotheses, which state that;

H1. Information sharing has positive and significant effects on supply chain performance.

H2. Information sharing has positive and significant effects on supply chain visibility.

H3. Information sharing has positive and significant effects on supply chain collaboration.

H4. Information sharing has positive and significant effects on supply chain agility.

2.3.2 The relationships between supply chain collaboration, agility, performance and supply chain visibility. Supply chain visibility depends on the propagation of relevant and up-to-date information among network partners to achieve goals of enhanced collaboration, agility and performance (Barrat and Oke, 2007; Blome *et al.*, 2013; Dubey *et al.*, 2020). Past studies indicate that supply chain visibility, which is dependent on sharing of meaningful information across supply chains presents benefits for supply chain collaborations, agility and performance than supply chains that lack information sharing (Barrat and Oke, 2007; Brusset, 2016; Caridi *et al.*, 2014). Apparently, visibility in supply chains improves collaborations since it makes supply chain partners feel updated and integrated into supply chain initiatives leading to building of trust and commitment. The presence of trust and commitment in supply chains will likely ensure superior supply chain performance as well as agility because when supply chain partners work together as a single unit, it breeds resilience to uncertainties as well as risks (Braunscheidel and Suresh, 2009). Practically, visibility in supply chains enhances flexibility, which makes adaptations to market changes and trends faster, easy and less costly. As such, the influence of visibility in supply chains is very robust and significant especially in relation to supply chain performance. Blome *et al.* (2013) emphasized that improving supply chain performance is crucial for organizational growth and survival in current competitive environments and as such, firms needed to evaluate and improve supply chain practices to improve overall performance. From this perspective, supply chain visibility which relies on efficient information sharing will likely promote or improve supply chain collaborations, agility and performance because through visibility, relevant data relating to customer orders, preferences and perceptions as well as competition trends and dynamics can easily be disseminated across the supply chain for fast decision making and response to these changes thus enhancing collaborative efforts, agility and performance in supply chains. From the discussion, it is evident that supply chain visibility has critical impacts on supply chain collaboration, supply chain agility and supply chain performance. Thus, we propose the hypotheses which states that

H5. Supply chain visibility has positive and significant influences on supply chain collaboration.

H6. Supply chain visibility has positive and significant influences on supply chain agility.

H7. Supply chain visibility has positive and significant influences on supply chain performance.

2.3.3 The relationships between supply chain agility, performance and supply chain collaboration. Supply chain collaborations according to Feizabadi *et al.* (2019) have been the driving force behind effective and efficient supply chain management practices and as such, require necessary attention because of the enormous gains it can present when well implemented. The authors further indicated that collaborative practices in supply chains are critical in creating firm capabilities as well as improving performance. From the relationship and information sharing/processing perspectives, collaborations help in building lasting relationships with supply chain partners due to synergistic efforts based on accurate and timely information from all partners. Highlighting on information processing, collaborations in supply chains enables better practices due to joint-knowledge creation, resource combinations and leveraging as well as fast problem solving, which emanate from joint information sharing and decision making (Feizabadi *et al.*, 2019; Dubey *et al.*, 2020). Furthermore, past studies on supply chain collaboration indicate key benefits for firm and partners (Cao and Zhang, 2011; Wolf, 2011). In detail, collaborations in supply chains have been associated with benefits such as risk sharing, inter-organizational learning, knowledge acquisition, joint-problem solving among others. These benefits to name a few significantly affect the overall performance of supply chains and the firm at large. Brusset (2016) and Blome *et al.* (2013) assert that cooperation in supply chains to a significant extent advances the agility and adaptability of supply chains and hence, collaborative efforts and strategies should be promoted to ensure mutual benefits for all supply chain partners. On this note, we hypothesize that;

H8. Supply chain collaboration positively and significantly influences supply chain agility.

H9. Supply chain collaboration positively and significantly influences supply chain performance.

2.3.4 The relationship between supply chain agility and supply chain performance. Supply chain agility from a theoretical perspective must be market sensitive, network-based, virtual and have process integration (Brusset, 2016). The existence of the above mentioned components to a large extent improve supply chains response to changes that come from markets and competition ultimately leading to superior supply chain performance. In particular, supply chains being agile allow swifts adaptations to customer preferences in relation to taste, price and product specifications (Blome *et al.*, 2013). According to Yang (2014), agility in supply chains creates value within firms through cost efficiency, which is achieved through supply chain and logistics activities to improve profitability, sales, supply chain customers and partners satisfactions as well as supply chain performance. Additionally, Blome *et al.* (2013) further detailed that agile supply chains based on relevant information sharing, collaborations and visibility are capable of efficiently and effectively allocating and utilizing resources wisely as well as leverage assets and costs to create customer value, supply chain partner satisfaction, relational rents among others which in turn results in superior supply chain performance. From the above, we hypothesize that;

H10. Supply chain agility has a significant and positive effect on supply chain performance.

3. Research method

3.1 Data collection and common method bias (CMB)

Manufacturing SMEs constitute more than 90% of industries as indicated by the OECD report (2010). This motivated basing empirical study on a sample of manufacturing SMEs operational in the Ghanaian manufacturing sector. A robust review of the literature on the variables adopted in the study namely; information sharing, supply chain visibility, collaboration, agility and performance led to the development of questionnaires, which solicited data from manufacturing companies. One hundred and ninety samples were randomly selected based on Hair *et al.* (2013) submission that for a sample to be representative, it must be more than one hundred. The questionnaires were developed following the guidelines stipulated by Podsakoff *et al.* (2003) to minimize concerns of common method bias. Specifically, the questionnaires promised anonymity to respondents, obtained measures from diverse sources and well separated sections of measured items coupled with others.

The questionnaires were sent to managers of sample firms together with a cover letter detailing the purpose of the study and follow ups were done to show appreciation and serve as reminders for non-respondents after two to three weeks interval. After a period of three months, one hundred and seventy-nine questionnaires were received out of the total of one hundred and ninety questionnaires sent out. This indicated a response rate of about ninety percent (90%). Further scrutiny of the data indicated that four of the received questionnaires contained missing values and thus, could not be used in the data analysis. This study being quantitative in nature employed SmartPLS a partial least square structural equation modeling (PLS-SEM) and variance-based software program in making data analysis and assessment of the research model. Additionally, the use of survey has been associated with issues of bias in responses and so, the study used Harman's one factor test to curb common method bias issues as well as prove the soundness of model constructs. Following Baah *et al.* (2020a, b, 2021b) and Shashi *et al.* (2019) we assessed common method bias using the Harman's one factor test. This test as explained by Podsakoff *et al.* (2003) shows observed variables during an exploratory factor analysis (EFA) to examine if a single factor explains equal or above 50% of the cumulative variance. If a single factor explains equal or above 50% of the cumulative variance, then there exists issues of common method bias. Analysis using EFA and the principal component analysis extraction method procedure showed that the study is free from common method bias since the single factor explained 38.6% of the cumulative variance.

3.2 Description of measurement items

Measurement items used in the study were adapted after a thorough review of the literature. The questionnaires specified items to assess information sharing (adapted from Holcomb *et al.*, 2011; Cao and Zhang, 2011), supply chain visibility (adapted from Holcomb *et al.*, 2011; Barratt and Oke, 2007), supply chain collaboration (adapted from Cao and Zhang, 2011; Nyaga *et al.*, 2010), supply chain agility (adapted from Brusset, 2016; Gligor *et al.*, 2013) and supply chain performance (adapted from Beamon, 1999; Sezen, 2008). These items were assessed on a 5 point Likert scale where 1 represented strongly disagree and 5 representing strongly agree so respondents could indicate the extent to which they agreed or disagreed to each item. The study adopted a 5 point Likert scale based on the recommendation of Sachdev and Verma (2004) that it reduces respondents' frustration level and increases response rate and quality. These measurement items are captured in Table 2. It is worth noting that each construct captured five items except supply chain performance construct which captured eight items. However, items that had extremely low factor loadings of <0.50 were deleted from the model due to interference with model and path strengths. Presented below is Table 1 which shows the characteristics of manufacturing firms captured in the study.

Firm characteristics	Frequency	Percentages (%)
Number of employees		
<10	12	6.86
11–50	25	14.29
51–100	38	21.71
101–500	44	25.14
>500	56	32
Product type		
Wood, lumber products and processing	27	15.43
Leather products and processing	35	20
Textile and fabric products	21	12
Food and beverages	31	17.71
Rubber and other plastic products	23	13.14
Stationery and allied products	20	11.43
Others	18	10.29

Table 1. Profile of respondents ($n = 175$)

Ideally, Hair *et al.* (2013) indicate that factor loadings of <0.70 should be deleted from a model to enhance model and path strength. Although items SCV2, RP2 and RP3 had loadings of <0.70 as shown in Table 2, these were left in the model due to their contribution to model predictive relevance. Moreover, the model meeting all the measurement criteria thresholds indicates it has suitability, quality and soundness. Again Henseler *et al.* (2015) indicate that Cronbach's alpha (CA) and composite reliability (CR), which shows a model has internal consistency and reliability should be $\geq$ 0.70 and $\geq$ 0.60, respectively. Average variance extracted (AVE) which assesses the convergent validity of constructs on the other hand has to meet the threshold of >0.50. From Table 2, the indicated results for CA, CR and AVE shows that the constructs have internal consistency and reliability as well as convergent validity since these criteria meet their recommended thresholds. We further assessed if the model has issues of multicollinearity by examining collinearity statistics as presented in Table 2. The collinearity statistics (VIF) as indicated were <3 which is the recommended threshold according to Ringle *et al.* (2015).

3.3 Constructs discriminant validity

Further establishing the model has discriminant validity in addition to convergent validity as already established by the AVE, we assessed the model using Fornell-Lacker criterion and HTMT ratio suggested by Henseler *et al.* (2015). The Fornell-Lacker criterion according to Henseler *et al.* (2015) stipulates a model attains discriminant validity when square roots of AVEs are greater in comparison with correlations of other constructs in the model. The Fornell-Lacker criterion results presented in Table 3 indicated that the model achieves discriminant validity.

Finally, we assessed discriminant validity using the current best criterion in relation to PLS-SEM using SmartPLS software. This criterion which is HTMT ratio examines hetrotrait-heteromethod correlations relative to monotrait-heteromethod correlations and suggests that a model attains discriminant validity when HTMT ratios are <0.90. From Table 4, the model achieves discriminant validity since all correlations are below the recommended thresholds.

4. Results and discussions

This study adopted a positivist methodological paradigm, which focuses on the formulation and testing of hypotheses empirically. In addition, survey research design and a quantitative

Construct	Item	Measurement item	Factor loadings	Collinearity statistics (VIF)
Information sharing: (CA: 0.882); (CR: 0.914); (AVE: 0.679)	IS1	Our firm shares relevant information with supply chain partners	0.786	1.997
	IS2	Our firm exchanges timely information with supply chain partners	0.871	2.591
	IS3	Our firm shares accurate information with supply chain partners	0.865	2.607
	IS4	Our firm and supply chain partners share confidential information	0.775	1.786
	IS5	Our firm and supply chain partners share complete information	0.820	2.095
Supply chain visibility: (CA: 0.802); (CR: 0.869); (AVE: 0.624)	SCV1	Share information with supply chain partners about demand shifts and changes in customer preference	0.801	1.808
	SCV2	As the focal firm, we exchange performance evaluation information with supply chain partners	0.693	1.450
	SCV3	Our company exchanges information concerning inventory and order forecasting with partners	0.823	1.870
	SCV5	Our company involves stakeholders in customer preference and new product requirement decisions	0.836	1.632
Supply chain agility: (CA: 0.821); (CR: 0.881); (AVE: 0.651)	SCA1	Our firm quickly detect and adapt to changes, threats and opportunities and	0.738	1.464
	SCA2	Our firm frequently modify tactics and operations when needed	0.792	2.015
	SCA3	Our firm is able to quickly make decisions	0.792	1.982
	SCA4	Our firm is able to implement decisions quickly in response to market changes	0.896	2.514
Supply chain collaboration: (CA: 0.767); (CR: 0.851); (AVE: 0.588)	SCC1	Our firm and supply chain partners share benefits and costs (e.g. inventory cost savings and loss on order changes)	0.780	1.570
	SCC2	Our firm and supply chain partners jointly plan to achieve supply chain goals	0.738	1.358
	SCC3	Our firm and supply chain partners have agreements on the importance of collaborations in the supply chain	0.715	1.743

Table 2.
Measurement items description

(*continued*)

Construct	Item	Measurement item	Factor loadings	Collinearity statistics (VIF)
	SCC5	Our firm and supply chain partners collaboratively share costs, risks and benefits	0.831	2.148
Supply chain performance: *flexibility and resource performances*: (CA: 0.833); (CR: 0.879); (AVE: 0.550)	FP1	Ability to respond to and accommodate demand variations	0.824	2.335
	FP2	Ability to respond to and accommodate periods of poor supplier performance	0.794	2.110
	FP3	Ability to respond to and accommodate periods of poor delivery performance	0.753	1.837
	RP1	Costs associated with held inventory	0.795	2.392
	RP2	Total cost of resources used	0.646	1.535
	RP3	Total cost of manufacturing, including labor, maintenance and re-work costs	0.614	1.492

Table 2.

Construct	1	2	3	4	5
1. Information sharing	*0.824*				
2. Supply chain agility	0.285	*0.807*			
3. Supply chain collaboration	0.366	0.606	*0.767*		
4. Supply chain performance	0.633	0.597	0.658	*0.742*	
5. Supply chain visibility	0.334	0.564	0.614	0.715	*0.790*

Note(s): Italics values represent the square root of AVEs of constructs

Table 3.
Fornell-Lacker criterion

Construct	1	2	3	4	5
1. Information sharing					
2. Supply chain agility	0.328				
3. Supply chain collaboration	0.454	0.743			
4. Supply chain performance	0.742	0.711	0.819		
5. Supply chain visibility	0.374	0.650	0.751	0.801	

Table 4.
Heterotrait-monotrait ratio (HTMT)

approach to data analysis using SmartPLS a PLS-SEM based software program were employed to collect relevant data and make interpretations because of its efficiency and suitability for predictive research models as adopted in this study (Hair *et al.*, 2013). PLS-SEM was employed due to its ability to deliver better results compared to covariance-based SEM for complex models, being a variance-based technique (Hair *et al.*, 2013). Additionally, SmartPLS software 3 as used in this study is grounded in path regression, factor analysis, testing and generation of standardized regressions in structural models. The software further provides measurement criteria that assert a structural models suitability, reliability and validity (Henseler *et al.*, 2015). Since the constructs in the structural model meets reliability and validity thresholds as already indicated, the next step is to assess the structural model

and test hypotheses by examining the variances of dependent variables explained by independent variables in addition to the model's predictive relevance using Stone-Geisser's Q^2, path coefficients (β) and significance levels (p-values).

According to Hair *et al.* (2013) predictive researches or models need to report Stone-Geisser's Q^2 to show predictive relevance and thus SmartPLS as an SEM tool is considered ideal for such studies. Through running the blindfolding procedure, Stone-Geisser's Q^2 values are ascertained and a model has predictive relevance if Q^2 values are >0. As indicated in Table 5, the blindfolding procedure showed that the model has predictive relevance since Q^2 values are >0. Specifically, Q^2 values for supply chain visibility, collaboration, agility and performance were 0.058, 0.215, 0.245 and 0.364, respectively. Furthermore, the structural model predicted 0.112, 0.407, 0.427 and 0.737 of the variances of supply chain visibility, collaboration, agility and performance, respectively, as indicated in Table 5.

Moving to the discussion, analysis of the data showed that H1 which sought to establish the positive and significant effect of information sharing on supply chain performance was supported (total $\beta = 0.633$, $T = 9.314$). The significance of both direct and indirect effects of information sharing as indicated in Table 6 shows the need for manufacturing firms to efficiently share information to boost performance of supply chains. This finding agrees with Lofti *et al.* (2013) and Colicchia *et al.* (2018) in asserting that the true value of sharing

Table 5.
R^2 and Q^2 of structural model

Endogenous constructs	R square (R^2)	R square adjusted	Stone-Geisser's Q^2
Supply chain visibility	0.112	0.106	0.058
Supply chain collaboration	0.407	0.400	0.215
Supply chain agility	0.427	0.417	0.245
Supply chain performance	0.737	0.731	0.364

Table 6.
Results of hypothesis testing

Hypothesis	Direct (β)	Indirect (β)	Total (β)	Standard deviation	T statistics
H1: Information sharing to supply chain performance (s)	0.393***	0.240***	0.633***	0.068	9.314
H2: Information sharing to supply chain visibility (s)	0.334***	–	0.334***	0.082	4.085
H3: Information sharing to supply chain collaboration (s)	0.181***	0.185***	0.366***	0.090	4.081
H4: Information sharing to supply chain agility (s)	0.035*	0.250***	0.285***	0.081	3.536
H5: Supply chain visibility to supply chain collaboration (s)	0.554***	–	0.554***	0.046	12.055
H6: Supply chain visibility to supply chain agility (s)	0.302***	0.226***	0.528***	0.057	9.308
H7: Supply chain visibility to supply chain performance (s)	0.381***	0.185***	0.567***	0.044	12.836
H8: Supply chain collaboration to supply chain performance (s)	0.184***	0.065***	0.248***	0.066	3.767
H9: Supply chain collaboration to supply chain agility (s)	0.408***	–	0.408***	0.078	5.210
H10: Supply chain agility to supply chain performance (s)	0.158***	–	0.158***	0.060	2.641

Note(s): (s), supported; *not significant at 0.05 significance level (two tailed); ***significant at 0.05 significance level (two tailed)

information across a supply chain presents benefits that outweighs the cost and as such firms that are supply chain rooted or based need to critically examine and leverage information sharing as a weapon in current competitive arena to gain superior performance. The analysis further connoted that H2 which centered on the positive and significant influence of information sharing on supply chain visibility was supported (total $\beta = 0.334$, $T = 4.085$). This finding harmonizes with findings from several scholars (Colicchia *et al.*, 2018; Feizabadi *et al.*, 2019) who agree that information sharing forms a vital component of supply chain visibility. An in-depth view suggests that information sharing goes to the core of supply chain visibility in that through disseminating relevant and timely information current practices and preference of customers and markets can be anticipated and responses initiated leading to improved collaborations and agility as well as performance. Additionally, the significance of the direct effect of information sharing on supply chain visibility (see Table 6) further proves the concept of information sharing and how it interacts with visibility and other supply chain concepts needs further investigation seeing current competition is on supply chain basis.

Form Table 6, hypothesis 3 (H3) which aimed at establishing the positive and significant impact of information sharing on supply chain collaboration was supported (total $\beta = 0.366$, $T = 4.081$). Cao and Zhang (2011) indicated in their study that information sharing forms a critical part of ensuring effective collaborations among supply chain partners. This finding supports the assertion of the authors in that, both direct and indirect effects of information sharing on supply chain collaboration indicated positive and significant influences (see Table 6). In addition, Feizabadi *et al.* (2019) also indicated that collaborations in supply chain in these current times requires relevant integration of information technology to enable faster and significant flow of useful information in a timely manner. The authors in consonance with Jimenez-Jimenez *et al.* (2018) also captured information sharing as a vital aspect of collaboration in supply chains. From these it is obvious as to how information sharing enhances collaborations and overall performance of supply chains. Regarding hypothesis 4 (H4) which sought to indicate the positive and significant impact of information sharing on supply chain agility, the analysis of the data showed that the total effect of information sharing on supply chain agility was positive and significant thus H4 was supported (total $\beta = 0.285$, $T = 3.536$). Although the hypothesis was supported on the basis of total effect, the direct effect from information sharing to supply chain agility was not significant. This can be attributed to the fact that more attention and focus have been placed on achieving other supply chain benefits such as visibility and collaboration and thus, less specific efforts are placed on achieving agility. However, placing emphasis on other supply chain benefits or concepts such as collaboration and visibility eventually lead to agility, hence the significance of the indirect effect from information sharing to agility giving a positive and significant total effect. This finding supports Brusset (2016) and Yang (2014) in indicating that information sharing enhances supply chain agility which ultimately also enhances supply chain performance.

Furthermore, supply chain visibility sough to establish a positive and significant influence on supply chain collaboration (H5), supply chain agility (H6) and supply chain performance (H7). To start with supply chain visibility has been deemed as very beneficial to establishing superior performance in supply chains (Barrat and Oke, 2007; Holcomb *et al.*, 2011; Colicchia *et al.*, 2018). Analysis and scrutiny of the data indicated that supply chain visibility has a significant and positive effect on supply chain collaboration, thus supporting hypothesis 5 (H5) (total $\beta = 0.554$, $T = 12.055$). This enormous impact of supply chain visibility on supply chain collaboration shows that for there to be effective collaborations in supply chains there is the need for visibility as well. This is sensible in that visibility ensures trust which also leads to building strong relationships that ensure mutual gains for all partners. Cao and Zhang (2011) and Feizabadi *et al.* (2019) indicated support for finding by

also asserting that information sharing enhances visibility which boosts collaborative efforts. Again, supply chain visibility which sought to establish a positive and significant effect on supply chain agility (H6) was supported (total $\beta = 0.528$, $T = 9.308$). The results from the data analysis showed a robust total effect of supply chain visibility on supply chain agility. This finding is not far from the findings of Yang (2014) who asserted that agile supply chains require visibility in order to improve flexibility which aids in efficiently and effectively responding to market changes in terms of preferences and demands. Brusset (2016) also posit that attaining visibility ensures quick adaptability and responses to competition and changing market trends. The results indicate that both direct and indirect effects of visibility on agility were positive and significant as indicated in Table 6. Hypothesis 7 was also supported (total $\beta = 0.567$, $T = 12.836$) thus showing the importance of supply visibility in improving supply chain performance. This robust influence of supply chain visibility on supply chain performance can be viewed from the perspective that visibility as established in this study is very vital for supply chain collaboration and agility which also influences supply chain performance. Holcomb *et al.* (2011) indicate support for this finding by asserting that enhancing supply chain visibility enhances connectivity in supply chains thereby reducing uncertainty as suppliers' performance increase leading to superior supply chain performance. Supply chain visibility is very important in supply chains and thus, should attract more efforts in order to stay competitive. The statement is supported since both direct and indirect effects of visibility on performance were significant as presented in Table 6 and shown in Figure 2.

Moreover, hypothesis 8 (H8) which states supply chain collaborations is positively and significantly associated with supply chain performance was supported (total $\beta = 0.248$, $T = 3.767$). As explained in the literature review, effective supply chain collaborations guarantee gains for supply chain partners as well as for the overall supply chain (Blome *et al.*, 2013; Colicchia *et al.*, 2018; Feizabadi *et al.*, 2019). Jimenez-Jimenez *et al.* (2018) specifically indicated that engaging in supply chain collaborations allows for joint-knowledge sharing, joint-problem solving, acquisition of relational rent among others that go to better overall supply chain and firm performances. Having indicated the above, the study finding supports

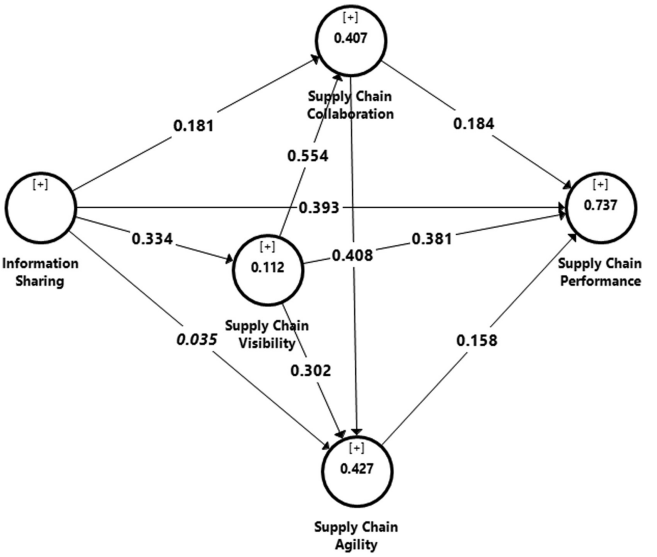

Figure 2.
Structural model showing direct path coefficients (β) and variances explained (R^2)

the above statement by showing a positive as well as a significant effect of supply chain collaboration on supply chain performance. Moreover, the significance of both direct and indirect effects of supply chain collaborations as shown in Table 6 proves the importance of engaging in collaborative initiatives at supply chain levels seeing the enormous benefits it presents. In addition, analysis of the data indicated that the hypothesis 9 (H9) which sought to establish the positive and significant impact of supply chain collaboration on supply chain agility was supported (total $\beta = 0.408$, $T = 5.210$). This finding indicates that supply chain collaborations have a robust influence on supply chain agility. This can be attributed to the fact that when supply chain partners work together as a single unit there is the creation of flexibility which helps in fast responses to customer demands and market changes. Moreover, collaborative efforts also promote benefits which boost firms' ability to quickly respond to market issues. For instance, joint-planning, joint-problem solving and joint-knowledge sharing as indicated by Feizabadi *et al.* (2019) enables focal firms together with supply chain partners to quickly make decision as well as solve problems regarding price, quality, quantity among others in the quest to satisfy customer wants and demands hence promoting flexibility to easily and quickly adapt to market changes which is the basic essence of supply chain agility.

Finally, hypothesis 10 (H10), which centered on the positive and significant impact of supply chain agility on supply chain performance was also supported (total $\beta = 0.158$, $T = 2.641$). Supply chain agility which has been known to base on supply chain visibility and collaboration will definitely have positive and significant impacts on supply chain performance. This is because agility in supply chains makes it possible to respond to customers and other stakeholders thus, boosting satisfaction which leads to larger market shares and stakeholder support or endorsement (Brusset, 2016; Yang, 2014). Having highlighted the above, the study finding is supported and as such, firms are encouraged to ensure agile supply chains in order to reduce risks associated with market volatilities, thus ensuring improved supply chain performance. Specifically, the ability to quickly adapt to market changes critically impacts a firms supply chain performance and competitive position. Thus, firms that seek to ensure sustained or improved supply chain performance and competitive positions should go in for supply chain agility based on useful information sharing, supply chain visibility and collaborations.

Although not hypothesized the study in further contributing to literature assessed the mediating roles of supply chain visibility, collaboration and agility in the relationship between information sharing and supply chain performance. The results presented in Table 7 indicated that supply chain visibility had a complementary mediation effect on the information sharing and supply chain performance relationship ($\beta = 0.127$***, $T = 4.450$). Additionally, supply chain collaboration presented no mediation effect seeing that the direct effect between information sharing and supply chain performance was significant but the indirect effect through supply chain collaboration was not significant ($\beta = 0.033$*, $T = 1.663$).

Path	Coefficient (β)	Standard deviation	T statistics
Information sharing – > Supply chain visibility – > Supply chain performance	0.127***	0.029	4.450
Information sharing – > Supply chain collaboration – > Supply chain performance	0.033*	0.020	1.663
Information sharing – > Supply chain agility – > Supply chain performance	0.005*	0.011	0.048

Note(s): *Not significant at 0.05 significance level (two tailed); ***Significant at 0.05 level (two tailed)

Table 7.
Specific indirect effects

Finally, supply chain agility also present no mediation effect between information sharing and supply chain performance ($\beta = 0.005$*, $T = 0.048$) since the indirect effect was not significant as compared to the direct effect. These findings indicate that supply chain visibility is vital for realizing the goals of information sharing and supply chain performance. Although previous studies indicate the relevance of supply chain collaboration and agility in mediating the relationship between information sharing and supply chain performance, the no mediation effect as obtained in this study indicate the need to probe further on the interactions between these adopted study variables so to better understand the widening scope of information sharing in supply chains.

5. Conclusion

Recent diversifying nature of competitions and business environments to a large extent have influenced current practices that aim at acquiring and sustaining superior advantages and performance in supply chains. Managers in particular are tasked with exploring ways to achieve and sustain competitive positions at supply chain levels. Thus, promotion of practices that seeks to strengthen supply chains have been focused on in past studies. Although supply chain has received attention over the years with information sharing being used in the explanation of supply chain concepts, few studies have centered on modeling information sharing as a variable to assess how it interacts with other key supply chain variables with both direct and indirect focus. This study sheds light on how information sharing, a critical component in supply chains interact with supply chain visibility, collaboration, agility and performance. Currently, it is important for companies to seek superior supply chain performance to better position themselves with regards to competitors. The inability to compete on supply chain basis in this present business environment especially for manufacturing firms means poor supply chain collaboration, visibility, agility, performance as well as low competitive prowess.

Having highlighted the above, it is worth mentioning that engaging in information sharing carries enormous benefits which lead to improved supply chain visibility, collaboration, agility and superior performance. The study findings further indicated that supply chain visibility which was also based on relevant information sharing further significantly influenced collaborations, agility and performance in supply chains. Supply chain collaboration and agility also based on useful information sharing had significant impacts on supply chain performance. This proves the relevance of information sharing in supply chains and as such, academics can further conduct studies that seek to capture other key supply chain concepts to aid in a much wider understanding of information sharing impacts in supply chains. Managers, on the other hand, can base on the findings of this study to intensify information sharing practices or make information technology investments seeing the wide range of benefits it presents to focal firms. Although the quest to better competitive positions will never end, understanding the relevance of how information sharing interacts with other variables or concepts in supply chains can be a weapon in achieving superior supply chain and overall firm performance.

5.1 Implications for theory

In comprehending what makes supply chains yield superior and sustained competitiveness, collaborative advantage and performance, the study basing on the relational view, resource based view and the extended resource based view highlights the benefits that accrue to firms that engage in information sharing to boost supply chain visibility, supply chain collaboration, supply chain agility and supply chain performance. The adopted theories indicated that diverse firms on the basis of improving supply chain collaboration, visibility

and agility through sharing vital and meaningful information across supply chain units and with partners have gained internal rents, relational rents and dynamic capabilities which aid in the effective and efficient utilization and combination of firm resources which lead to supernormal profits and collaborative alliances. Specifically, the study results indicated that the direct and indirect interactions of the study variables namely; information sharing, supply chain visibility, collaboration, agility and performance were mostly robust and positive. Thus, supporting the adopted theories in asserting that engaging in information sharing that improves supply chain visibility, collaboration and agility will end up in higher supply chain performance and supernormal profits through the accumulation of internal rents, relational rents and dynamic capabilities.

5.2 Implications for practice

Primarily, the study reveals that information sharing forms a vital component in building supply chain visibility, supply chain collaborations, supply chain agility and supply chain performance. This recommends to managers that key efforts should go into disseminating relevant and meaningful information to promote visibility, collaborations and agility which also leads to higher supply chain performance and competitiveness. Therefore, managers should ensure that timely, accurate, vital and meaningful information exists in supply chain networks to enhance management of supply chain stakeholders' and also avoid stakeholder withdrawals. Although, information sharing is considered crucial in promising superior outcomes, it is important to note that supply chain visibility, supply chain collaborations and supply chain agility also play similar vital roles in ensuring sustained and improved performance levels. As such, information sharing that leads to enhanced supply chain visibility, supply chain collaborations and supply chain agility as captured in this study presents win-win scenarios for firms, policy makers and managers.

5.3 Limitations and suggestions for future studies

The study has few limitations which can be captured in future studies to enhance knowledge on supply chains in a wider context. First, the study centered on manufacturing firms and thus, findings to an extent are restricted to such industries. Future studies can consider other sectors since all firms have supply chains. Second, variables adopted in this study were modeled as composites thereby to an extent minimizing the comprehensiveness of these concepts. Further studies can model some of these variables on their sub-components or dimensions to provide a further understanding on these concepts. Lastly, it will be vital if data could be captured over a period of time to enhance correct determination and understanding of the long-term influence of information sharing on supply chains especially seeing the ongoing change in information technology platforms. Capturing these current paper limitations will to a large extent better the understanding of these supply chain concept for both academics and practitioners.

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Corresponding author
Charles Baah can be contacted at: charlieba3@gmail.com