
Analytical study of supply chain collaboration guiding forestry products supply in a developing economy

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Abstract: This research is an empirical assessment of wood products supply chain in a developing economy using Bodija wood market in Ibadan, Nigeria as case study. The study examined the nature of supply chain collaboration employed by the operators to achieve their business objectives and the roles played by extant government rules guiding SC of wood products. The study is based on a randomly selected set of 147 constituents of the SC. Two hypotheses were tested in the study, evidence from the study shows that supply chain relationship is positively influenced by reduction in operational costs and higher levels of customer's relationship. Further analysis shows that extant governmental policies have significant influence on supply chain performance (SCP). Policies on taxation, and forest management techniques have strong influence on achievement of benefits of the chain. The paper suggests tangible business and policy measures for the development of wood products SC in Nigeria.

Keywords: supply chain; SC; supply chain relationship; SCR; wood products; developing economy, government policies.

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1 Introduction

1.1 *Nature of supply chain collaboration in wood products industry*

Assessment of the nature of supply chain collaboration (SSC) that exists among the constituents of supply chain (SC) of wood products in a developing economy like Nigeria is germane for three major reasons; first, is the fact that forestry products are indispensable to the global, national and local economies. Official estimate of reported monetary contributions of forest resources to the economies of developing countries in 2012 exceeded US\$250 billion. This represented about 1% of the global gross domestic product (GDP) for that year (Agrawal et al., 2013). In Nigeria, though forestry products are not part of the national main export goods, the contributory role played by these products to the building industry are critical. Secondly, the last 30 years has witnessed huge depletion of these non-renewable natural resources. Analysts are alarmed at the rate at which the various forest reserves in the country are being consumed with little or no plan for sustainability (Faleyimu et al., 2013; Taru and Ndaghu, 2013).

Lastly, there is the need to examine the nature of SCC that exists among constituents of wood products suppliers and the effect of such collaborative relationship on the achievement of SCM goals such as a reduction in the operational cost, and an increment in customer's satisfaction (CS) in a developing economy. Literature search revealed that scholars generally believed that SCCs among constituents of forestry products SC are inevitable. To this end, there has been a growing numbers of researches that has applied operational research (OR) techniques to evaluate the benefits inherent in functional SCC among constituents of forestry product SC. Some of such are the works of Beaudoin et al. (2007), which addressed how different firms operating in the forest product industry can harmonised their harvesting schedules through collaborative relationship. Carlsson and Reonnqvist (2006), Frisk et al. (2006) and Audy et al. (2007) examined the benefits of collaborative relationships among firms in aspect of transporting harvested logs from farms to mills, while Vermeuleng and Seuring (2009) examined the effects of SCC on salient theme of energy consumption, climate change and governance influence on the achievement of sustainable SCM. Diniz and Fabbe-Costes (2007) contributed to the discourse by focusing on the importance of collaborative relationship in the management of residues in the timber SC in Brazil. A general trend in most of these cited works is the use of OR in resolving problems associated with SCM of forestry products. OR techniques have proven to be one of the most preferred analytical solutions in resolving problems associated with SCM of forestry products. It is not however without flaws. Making sweeping generalisations based on findings from such studies can be misleading, most especially in a milieu where there are paucities of secondary data to help in providing trends of activities over time and where rigorous deployment of strong IT infrastructure in management of enterprise system is at its infancy or virtually non-existent.

There are also peculiar differences in theories and practices of SCM between the developed nations of the first world and what obtains in developing nations of the third world. Substantiating this fact, Wood et al. (2002) succinctly captured it thus; ".....In developed nations, businesses enjoy the best logistics and transportation professionals, systems, and infrastructure in the world. Managers take for granted such standards as advanced internet-based technologies, high-capacity national highway systems, broad-band fiber-optic communications capabilities, seamless multimodal transportation,

modern port facilities, high-density air control.....What is experienced as the norm of logistics practice in the developed countries is often only aspirational goal of logisticians in many other places in the world". Based on this premise, this work therefore differs from previous works on the discourse by examining the gap in existing literature on the nature of SCC that occurred among constituents of forestry products SC and the effect of such on the health and sustainability of the collaborative relationship in a developing economy. It is also assumed that the use of Business Ecosystem Health Theory and Principal and Agent theory as done in this study, will provide an alternative theoretical lens in extant literature of SCC among constituents of wood products, the theories have been previously used in providing generally accepted scientific models for risk assessment and risk sharing strategies among constituents of SC engaged in different types of collaborative relationship (Zsidisin and Ritchie, 2008). The roles that governmental policies exert on existing collaborative relationship among members of forest products SC are also examined. Contemporary researches have observed that governmental policies more than ever are increasingly becoming a key determinant of success of SCM globally (Wood et al., 2002; Vermeuleng and Seuring, 2009; Monios and Beqvist, 2015). A good example is the recent work of Clott et al. (2014), which critically examined different operational and governance issues that needed to be addressed for some degree of equilibrium to exist between the flow of inbound loaded containers and the corresponding outbound transport of exported agro commodity (soybeans) from the US state of Illinois.

This work is divided into five sections; after this introductory section, the second is dedicated to description of the study area, the third reviews relevant literature, examines theoretical underpinning and hypotheses forming thereafter followed. The fourth is dedicated to the methodology and discussions of findings while the fifth section concludes the study.

2 Study area

2.1 Timber exploitation activities in Nigeria

Timber exploitation in Nigeria dates back to pre-colonial period when timber products from different forest zones of the southern part of the country formed part of the pre-colonial trade between the natives and Europeans voyagers. The trading across international waters however peaked during the colonial period between 1800–1960; the construction of hinterland roads made accessibility to some of these forest easier. Initially, pit saws were used in cutting fell timber logs to sizes from where they were transported by portage to points of loading. The advent of strong lumber vehicles and sawing machines doubtlessly contributed significantly to the growth of the industry (Adeyoju, 2001; Faleyimu et al., 2013). Consequently, timber products became a sizeable proportion of the national income, this trend continued until the oil boom era, when exportation of petroleum products took over as the mainstay of the Nigerian economy.

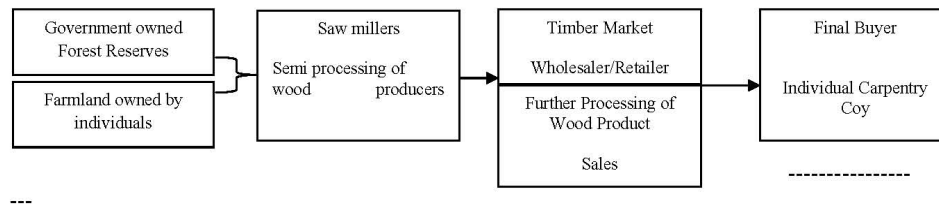
Timber production thereafter has been mainly for local consumption. Major consumers of forestry products locally are the building and furniture industries. However significant proportions go into energy generation, particularly by the low income households in both rural and urban centres (FORMECU, 1998). Relentless harvesting of trees without proportionate replanting in the last four decades, has led to shrinkage in

vegetal land cover in Nigeria (Visser, 2010). There are also growing concerns among stakeholders, particularly ecologists on the depletion of the forest resource in the country. The upsurge in illegal harvesting of forestry product is also another nagging problem that is worrisome to all genuine stakeholders (Faleyimu et al., 2013).

Wood industry is not a major contributor to the national export, but its role as source of employment and finance to the country's economy particularly in the informal sector cannot be downplayed. Until recently, a cursory observation of the pattern and processes governing the SC of forestry products in Nigeria reveal a system of informal private sector driven arrangement with very little government interference. A substantial proportion of the raw materials are sourced from individual or community owned farmlands often classified as 'free area'. Some harvested timbers from this source are not cultivated in real terms as there are no deliberate efforts to plant and nurture the timber products. Toward harvesting, these wild categories of timber products catches the attention of speculators once it is of the right specie.

The other major sources of raw materials are the government owned forest reserves. The Southwestern region of Nigeria has 85 constituted forest reserves with an area cover of 842,499 hectares, Oyo state government (the study area) owns a significant 18 (nearly 22%) of these reserves which in real term represents 169,173 hectares (FORMECU, 1998; Faleyimu et al., 2013). The other sources are the privately owned forestry reserves; a novelty in Nigeria, given its latter day emergence, Faleyimu et al. (2013) reported that the total land covered by privately owned forest reserves in the entire country as of 2005 is 1,619.19 hectares.

Figure 1 Wood products SC in South West Nigeria

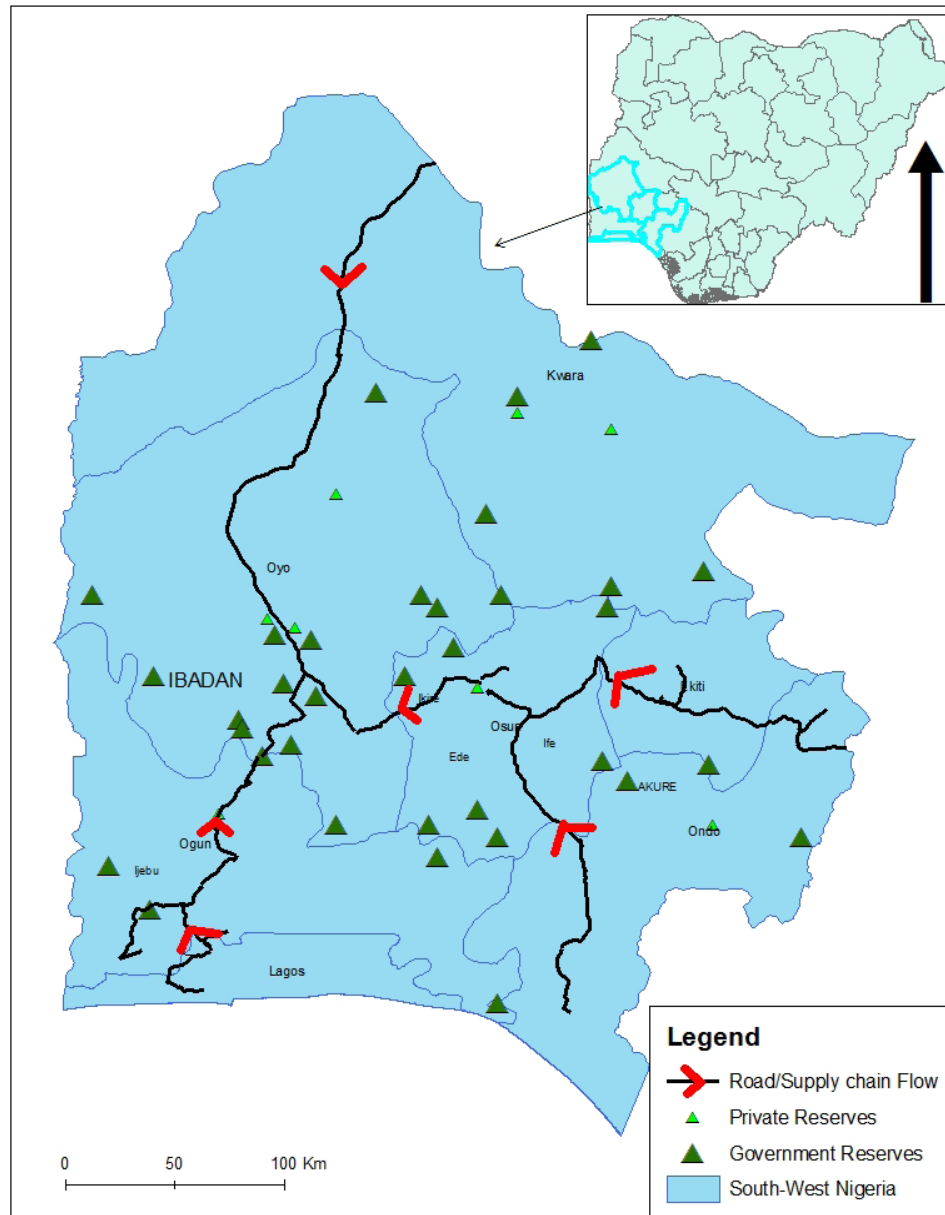


2.2 Bodija international wood products market

Historical account has it that, the first wood products market in Ibadan was located at Oke-Bola, a residential neighbourhood at the southern end of the metropolis. Ibadan is the capital of Oyo-state, an important break of bulk point and a frontier city between the southern tropical forest zone and the northern grassy savannah zone of Nigeria (Ajayi and Ajayi, 2013). The market was closed down in 1970 due to health, safety and environmental concerns. The relocation of the wood market to the present site at the northern end of the city was therefore done to satisfy nagging needs. The market presently sits on large piece of land (approx, 300 hca). The wood products market in Bodija is the biggest in Western Nigeria and arguably one of the biggest in Nigeria and West Africa. It shares some of its space with the city owned abattoir and Bodija International food market, a choice destination for buyers of all types of food items. The wood market is divided into ten zones; nine of which are designated as sales points for wood sellers. Each seller is allotted a stall for operation. Some stall owners provide

additional services apart from wood products sales, such as automated wood cutting machines which are used for wood cutting and re-sizing. The tenth and the last zone is dedicated to artisans engaged in ancillary services such as carpentry, furniture making and other forms of wood works.

Figure 2 Analysis of SC route/flow of wood products into Bodija Market, South West Nigeria (see online version for colours)



The market has provision for a trailer park where haulage vehicles used for long haul of the products are parked. Planks of various sizes are stacked by sellers in their sheds which are built of woods and covered with corrugated iron roofing. The standard sizes of the planks directly from sawmills are 1' × 12 × 12 feet, 2" × 6 × 12 feet, 3" × 4 × 12 feet and 2" × 12 × 12 feet. Sawmills that service the market are scattered all over different towns and cities, some are hundreds of kilometer away in S/western Nigeria (Ikire, Ile-Ife, Ondo, Akure, Owo, Ijebu-Ode). Investigations reveal that due to the weight of timber logs, investors as a rule of thumb build sawmills near forest sources. The planks brought from the saw mills in the aforementioned sizes are further scaled down and re-sized into smaller dimensions. These newly re-sized planks are easier to convert for industrial use at the wood market, the new sizes are; 2" × 2 12 feet, 2" × 3" × 12 and 2" × 4" × 12. There are system of road networks that runs through the market, though the condition of the roads are bad, they connects the market to Lagos-Ibadan expressway on its southern exit, while the northern exit links it to the dual carriage Secretariat-Bodija expressway.

Governance of the market is by chosen members of the Union of Wood Seller's Association, which is the central body to which all sellers in the market must belong. A conservative estimate (given during interview with the leaders in the market) revealed that there are more than 10,000 members, though a fraction of this are workers-in-training, who are at various stages of internship. Each of the ten zones in the market has a unit head who runs the affairs of the zone for a period of two years, these unit head submit to the central authority of the union which is headed by the state leader, assisted by other elected council members. Each zone is made up of 1,680 stalls. However conservative estimates put the total number of stalls in the market at 17,000. The study shows that apart from privately owned farms, government reserves identified as major supplier to the market are those located at Gambari, Ijaye, Lanlate, Olokemeji, Olasehinde and Opara forest reserves.

3 Literature review and theoretical underpinnings

3.1 SCC, its edge and drawbacks in SCM

In contemporary times, questions are being asked on the roles played by chain members as facilitators of efficient and cost effective distribution of products along the chain line (Bahinipati and Deshmukh, 2012; Simatupang et al., 2004). Analysts are of the opinion that there should be sincere collaborative arrangement backed by critical efforts on the management of relationship between constituents of SC. These are identified as been germane and key determinants of the sustainable business success (Barratt and Oliveira, 2002; Mentzer et al., 2001). The general perspective in extant literature corroborated this view. For instance, Mentzer et al. (2001) opined that there are huge differences in principle and practices between members of a SC, which is described as "a group of at least three entities (enterprises or individuals) directly involved in the flows (downstream and upstream) of products, services, capital and information that go from a source to a client" and what is obtainable among members of a well constituted and functional SCC. The proponents of this view contends that SCs, given the present thrust of globalisation of trade are inevitable for any meaningful flow of goods and services, as they emerge naturally to link products from its raw state, through semi-processed and processed states

to the clients through several organisations (Fabbe-Costes and Jahre, 2006; Kampstra et al., 2006; Horvath, 2001).

The authors also affirmed that, there are distinctions in scales and spheres of influence between SCs and SCC, According to Mentzer et al. (2001), SCs can exist independently from a formal plan or strategy, SCC on the other hand needs a “a deliberated managerial effort from the chain members”. Simatupang et al. (2004) defines SCC “as two or more independent firms jointly working to align their supply chain processes so as to create value to earn customers and stakeholders with greater success than acting alone”. It is a truism that when SCCs are properly integrated, collaborating firms leverage on available opportunities by sharing information and benefits (Kampstra et al., 2006; Horvath, 2001; Simatupang et al., 2004). When the level of collaboration is not strong, it aligns strongly with the view expressed by Kampstra et al. (2006) to the effect that “some business relationships are purely transactional’ and cannot therefore be seen as collaborative in the truest definition of the concept. They categorized some of such transactional relationships as ‘arm length relationship where a party win and the other loses; strategic alliances/joint ventures, which ensured some degree of shared ownership of gains/losses and vertical integration where there is a common ownership of members of the SC”. Kampstra et al. (2006) simplistic analysis shared some similarities with the use of the collaborative planning, forecasting and replenishment (CPFR) framework as an analytical tool for the fulfilment of business desire among collaborating enterprises (VICS, 2002; Bahinipati and Deshmukh, 2012; Simatupang et al., 2004; Ireland and Crum, 2005; Ramanathan and Gunasekaran, 2012). In an ideal situation a functional CPFR will include all business planning, sales forecasting and operations required to replenish raw materials and finished goods among collaborating enterprises (Blackstone, 2010; Ramanathan and Gunasekaran, 2012; Thomassen, 2013).

It is widely believed that a general approach to formal collaborative arrangement among firms engaged in a unique form of SC activities combine the skills, expertise and experiences of multiple trading partners in planning and fulfilment of customer’s demand (ECR Europe, 2001; Skjøtt-Larsen et al., 2003; Seifert, 2003; Blackstone, 2010; Ramanathan and Gunasekaran, 2012). Discourse in extant literature reveals that classifications of relationship in CPFR occur at three levels. These are basic CPFR, developing CPFR and advanced CPFR (ECR Europe, 2001; Danese, 2006). The basic CPFR is classified as a simple transactional relationship among SC partners [similar to Kampstra et al. (2006) classification]. In developing CPFR, higher level of trust is exhibited by collaborating firms since exchanges of vital data on demand ordering, promotional and production data are done. For advanced CPFR, it is believed that SC partners ought to have transparent information sharing system (Ramanathan and Gunasekaran, 2012).

The gains of a functional SCC are obvious, some of which are, effective coordination between the rate of order fulfilment and actual consumption, higher level of CS, just-in-time (JIT) deliveries, lower logistics costs, and seamless transfer of daily records from POS, to suppliers which help in distinguishing products with higher volume of turnover and from those with lower inventory costs (Simchi-Levi et al., 2003; Simatupang and Sridharan, 2002; Ramanathan and Gunasekaran, 2012). The first well publicised collaborative arrangement between upstream suppliers and downstream retailers occurred between Procter and Gamble and Wal-Mart in mid-1990s. The success story from that experience reverberated all over the SC world. It has since become a

reference point for analysts, managers and researchers when highlighting the success of SSC (Simchi-Levi et al., 2003; Bahinipati and Deshmukh, 2012; Barratt, 2004).

Arising from the success experiences in other industries, adaptation and application of SCC in forestry products SCM has also increased in recent times (Beaudoin et al., 2007; D'Amours et al., 2006). It has also proven quite viable in strengthening relationship among members in key areas of planning, forecasting, replenishment, information sharing, resource sharing and incentive sharing (Carlsson and Reonnqvist, 2005; Frisk et al., 2006; Audy et al., 2007; Lehoux et al., 2007). It can be argued however, that the categories of practitioners that presently constitute the link on forestry products in Nigeria are what Mentzer et al. (2001) described as SC. Although there are some collaborative relationships among the various constituents as revealed by this exploratory work, the collaboration appeared to be more transactional (Kampstra et al., 2006).

While it is true that effective collaborative SC does not “necessarily imply a need to use cutting-edge and expensive equipment, nor to emphasize rich teamwork at all stages” Ketchen and Hult (2007) there are linkages between these critical determinants and the ability to get SCC to achieve best value chain goals of agility, adaptability and alignment (Ketchen and Hult 2007; Lusch, 2011). Based on findings from this work, the integration of these salient factors in the pattern and processes of forestry products SC in a developing economy like Nigeria is definitely not at par with what obtains in Western Europe and North America. Evidences gleaned from extant literature have however proved that irrespective of the location, the desire of most managers is to create a visible pattern of coordination that paces the entire SC (Holweg et al., 2006). This, to reasonable extent will depend on the capability of members to create an integrative vertical collaboration, which is good for the overall health of SC (Fawcett et al., 2012). Empirical findings have revealed that the activities of one member of a SC may not necessarily have meaningful impact on other members of the chain (Tsoufas and Pappis, 2006), this can happen when roles are not clearly defined and when there are mistrust and suspicion among constituents. As observed by Cruijssen (2012), implementation of SC collaboration is not without drawbacks; there are always element of suspicion among chain members on the fairness in sharing of the costs and benefits. Achieving seamless and symmetrical compatibility among partners, can also be costly, time wasting and impracticable (Quesada et al., 2012; Delbufalo, 2012), while sustainable relationship and trust among such a complex crowded field can be daunting (Barrat, 2004; Alimirall and Casadeus-Masanell, 2010).

It is often advocated that, the general well being of the entire collaborative relationship should be seen as sacrosanct by all participants as any disturbance in the ‘health’ of the constituents of SCC may affect production activities and economic welfare of the others in the long term (Beamon, 1999; Tsoufas and Pappis, 2006). The next section is dedicated to the examination of theoretical focus of this work, the nexus between the theories of business ecosystem health, principal-agent relationships and their roles in the achievement of best value chain goals of agility, adaptability and alignment among collaborative chain members are discussed (Iansiti and Levien, 2004; Ketchen and Hult, 2007; Lusch, 2011).

3.2 *Theoretical underpinnings*

3.2.1 *Business ecosystem health theory*

Business ecosystem theory can be likened to the understanding of the dynamics of collaboration (interdependencies) between, several organisations in a chain and the unique business environment in which they operate (Iansiti and Levien, 2004; Hallikas and Varis, 2008). Scholars conceptualised the nature of interdependencies witnessed among chain members in a business network based on the understanding of similar scenarios among constituents of a biological ecosystem (Iansiti and Levien, 2004; Hallikas and Varis, 2008). In a biological ecosystem, the survival of every member of the system is dependent on the other; the disruption in any of the chain relationship (for example, food chain) will most definitely affect the survival of other chain members. The argument of the proponents of business ecosystem theory hinges on the fact that businesses in a chain relationship should systematically, identify the enterprise with which their future business plans are mostly in sync and thereby choose the collaborations that are most crucial to their survival (Iansiti and Levien, 2004; Hallikas and Varis, 2008; Galateanu and Avasilcai, 2014). The obvious wisdom in this is the reduction of risks that will likely results from being tied to many partners. Succinctly put; the larger the number of collaborating businesses in a chain, the higher the risk exposure should anything go wrong with any of the members.

It is an incontrovertible fact that the inevitability of dependability among collaborating chain members makes the possibility of increment in risk level real (Contractor and Lorange, 2002; Hallikas and Varis, 2008; Cruijssen, 2012), by simply engaging in different kinds of collaborative arrangement. Hallikas and Varis, (2008) asserted that companies involve in collaborative arrangement “naturally become more and more dependent on the other companies capabilities and resources, which makes their situation more unpredictable regarding possible changes in the business environment”.

Exploitation of latent benefits in business ecosystem by collaborating firms according to Hallikas and Varis (2008), will allow different value networks and core business to grow and co-evolve. Some scholars appeared to strongly believe that government support plays a critical role in achievement of sustainable value creation among collaborating chain members over time (Quayle, 2006; Elzarka et al., 2011). Government role as a catalyst to value enhancing relationship among chain member is therefore germane for optimal supply chain performance (SCP). Local companies leverage on governmental policies, norms and regulations to compete favourably against foreign competitors (Patterson et al., 2003; Clott et al., 2014). Elzarka et al. (2011) discovered how the Egyptian Government through series of reforms encouraged expansion in the clothing industries SC. Part of the tactics employed was facilitating logistic competencies of local firms by reducing administrative bottlenecks on both importation and exportation activities. This helped in achieving better lead time for products appearance in both local and international markets.

3.2.2 *Principal-agent theory*

One other theory that has gained prominence among scholars over time as a basis for providing a sound theoretical underpinning in analysing interrelationship among constituents of a SC is the principal-agent theory (Pratt and Zeckhauser, 1985; Eisenhardt, 1989; Seiter, 2008). The theory has been used variously in literature to explain the asymmetrical flow of finance, information, and its effect on functional and dysfunctional behaviour among collaborating partners within the SC network (Jensen and Meckling, 1976; Eisenhardt, 1989). The basic premise of the theory insist constituents of a chain relationship depends on each other actions directly and indirectly because, delegation of duties are understood as part of the principal-agent relationship. The agent is under binding obligation to undertake duty on behalf of the Principal, for which he is rewarded.

These various theories provide a theoretical basis for understanding the nature of interrelationships among chain members, and how this interrelationship affects the overall health and performance of the SC. The theories also contribute to the determination of the two hypotheses.

- H1 Supply chain relationship (SCR) among chain members engaged in wood SC has significantly reduced operational cost, increased the level of JIT deliveries/safety of goods and increased CS.
- H2 SCP is significantly influenced by the nature of extant governmental framework and regulation on wood products SC.

4 **Research methodology**

Information gotten during interview with the market leaders revealed that, there are slightly over 10,000 registered members as sellers in the market (wholesalers and retailers have same registration procedure). Large proportion of this number owns and operates sale points or sheds in the market. There are some who have evolved overtime to become 'timber contractor' a pseudonym used to describe loggers who have the financial muscle to vertically integrate all the activities in the chain under their business name. Two hundred respondents were randomly selected from the registered members. Since the market is divisible into ten different zones, emphasis was made to select at least 20 respondents from each zone, purposive sampling techniques was employed, this is because the research team relied on their judgement and knowledge of the market (gotten during the pre-test exercise of the research instrument) to get every constituents of the chain (Timber contractors, wholesalers, retailers, builders and haulers) involved as part of the sampled population. Interviews were also conducted with market leaders, leaders of National Union of Road Transport Workers (NURTW) and haulage truck drivers. A pre-field study (pre-test of the questionnaire) was conducted in order to test the reliability and validity of the research instrument, this was done in December 2013. The pre-field helped in assessing that the respondents, understood the instructions, questions, and response scales of the questionnaire as the researcher intended they should. The actual field work was done from December 2013 to August 2014 using, 2 trained field assistants. The final data sample size was 147 from the original 200 (nearly 73% response rate).

4.1 Scale development

To measure the variables Likert-like scale were employed. Some of such scales have been previously used in similar studies (Seiter, 2008; Patterson et al., 2006). New measurement items were developed to evaluate variables that appeared not to have been used in previous studies.

The development of the measurement item followed the established pattern in literature (Tan et al., 1998; Rosetti and Choi, 2005; Seiter, 2008; Simchi-Levi et al., 2003; Patterson et al., 2003). Operational definitions that are measurable were provided for constructs like 'extant governmental framework' and 'regulations'. The development of the items, their validity and reliability were ascertained during the pre-field exercise.

Furthermore in order to examine the internal reliability of the items in the research instrument, the Cronbach alpha test was carried out on each of the multi-item used in measuring the research variables.

Table 1 Cronbach's alpha coefficients of research variables

<i>Variable</i>	<i>Cronbach alpha</i>	<i>Variable</i>	<i>Cronbach alpha</i>
Supply chain performance	0.69	Supply chain relationship	0.75
Multiple tax/levies	0.70	Reduction in operational cost	0.78
Timber logging licensing	0.65	Safety and Security of goods-in-transit	0.70
Forest management technique	0.75	Customer's satisfaction	0.74

The Cronbach's alpha test allows the measure of internal consistency, this will reveal the level at which items in the measurement are interrelated. It evaluates the reliability of the scale, and it could improve the scale reliability by eliminating one or more items. A Cronbach's alpha lower than 0.60 means poor reliability, values between 0.6 and 0.7 are acceptable and values equal or higher than 0.70 indicate good scale reliability (Churchhill, 1979; DeVellis, 1991). Descriptive and inferential statistics are used to analyse the data and to test the derived hypotheses.

4.2 Results

Table 2 shows the breakdown of the functional distribution of the constituents of the supply chain. 7 (4.82%) of the respondents are those who are addressed as 'Timber Contractor', this category of respondents are those who finance the timber exploration activities. They also possess political connection to buy wood products from the government reserves across the South western region of Nigeria. 38 (26.20%) of the respondents are into wholesales of wood products. 72 (49.65%) are pure retailers who buy from the wholesalers scattered around the market. 13 (8.9) are retailers who are engaged in carpentry and furniture making ventures; they occupy the 10th zone in the market. The last group of respondents are haulers (3PLs) engaged in transshipment of wood products to and from the market, 15 (10.34%) are in this category. Findings from the interview sessions with the different constituents of the chain revealed their dispositions to the nature of interrelationships which exist within the chain. For generality

of Timber contractors their desire is to have vertically integrated value chain, where they assumed full ownership of the chain from privately owned forest reserves to the point of sales to final customers. In line with this desire, quite a sizeable number overtime have developed business relationship that is similar to what holds in principal-agent theory (Pratt and Zeckhauser, 1985; Eisenhardt, 1989; Seiter, 2008). The Timber contractors usually, act as principal to selected retailers by delegating certain tasks to them. Some of such functions include holding inventory stocks for the principal in what resembles collaborative relationship found in vendor managed inventory (VMI). The retailers helped in preventing stock out situation for the timber contractor in the market by making their storage facilities (stalls or sheds) available as additional storage and sales points within the market. The timber contractors in return, gives benefits such as bulk sales to selected numbers of ‘agents’ at a discounted rate, they also allow a flexible repayment plan that is mutually rewarding for the two parties. Other constituents of the chain, farm owners, transport service providers, and retailers, believed that the survival of the chain is more of a collective efforts and this tend to align more strongly with propositions of the business ecosystem health theory.

Table 2 Functional distribution of the constituents of the SC

<i>Serial number</i>	<i>Functional distribution</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
1	Timber contractor	7	4.76
2	Wholesalers	38	25.85
3	Retailers	72	48.97
4	Carpenters/builders	13	8.84
5	Haulers	17	11.56
Total		147	100

Source: Author’s fieldwork 2014

Table 3 Analysis of average monthly income of chain members

<i>Functional distribution</i>	<i>Average income</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
Timber contractor	N300,000–N1 m	7	4.76
Wholesalers	N150,000–N300,000	38	25.85
Retailers	N80,000–N200,000	72	48.97
Carpenters/Builders	N50,000–N150,000	13	8.84
Haulers	N200,000–350,000	17	11.56
Total		147	100

Source: Author’s fieldwork 2014

The respondents’ income analysis, as depicted in Table 3 aligns strongly with categorisation of the respondents with their functions within the SC. The Timber Contractors naturally have the highest annual income. Table 4 shows that nearly 80% of the trees converted into wood products are sourced from personal or private farms; the rest are gotten from government owned forest reserves. It must be noted that, government owned forest reserves are under tight regulatory regime. Findings revealed that some of these reserves, opened for timber harvesting once in seven years.

Table 4 Sources of wood products (harvested timber)

<i>Source</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
Privately owned farms	117	78.91
Government forest reserves	30	21.09
Total	147	100

Note: Sources of wood products (harvested Timber).

Source: Author's fieldwork 2014

Table 5 shows the respondents view on mode of information sharing among constituents of the chain, there is negligible usage of internet for business transaction, though 96% of the respondent uses the mobile telephone and short message services (SMS), every respondents agreed on the inevitability of timely and accurate information along the chain. However, it is observable that, the advent of mobile telephony has not totally obliterated the need for face-to-face communication along the chain. This is in tandem with similar findings (Osegowitsch and Madhok, 2003; Payne and Frow, 2004; Guan, 2010). Guan (2010) in particular, asserted, based on findings from study on timber product distribution channel in Sweden that, the incorporation of the newly emerged m-commerce channel (which includes mobile telephony, SMS, WAP and 3G mobile services) has significantly augmented the flow of information among multiple channel members. This he opined has encouraged a synergistic and seamless flow of information among multiple channel members.

Table 5 Mode of communication utilised by chain members)

<i>Preferred mode</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
Internet, 3G, WAP enabled	11	7.48
Mobile phone, SMS		
Mobile phone and SMS	136	92.51
Total	147	100

Source: Author's fieldwork 2014

Table 6 Most commonest species of wood sold/distributed

<i>Commercial name</i>	<i>Botanical name</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
Melina	Gmelina Arborea	25	17
Teak	Pericopsis Elata	33	22.44
Arere/Ogbeche	Lovoa Triccoloides	31	21.08
Ogao	Khaya Ivorensis	24	16.32
Iroko/Ebony	Diospyros Crassiflora	09	6.12
Cinderella	Cinderella Specie	25	17
Total		147	100

Source: Author's fieldwork 2014

Table 7 Influence of interrelationship among members on SC

<i>Benefits identified</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
Reduction in operational cost	24	16.32
Increment in profit for all	33	22.44
Safety of goods-in-transit	48	32.65
Better customer's satisfaction	42	28.57
Total	147	100

Source: Author's fieldwork 2014

Table 6 shows that the species of wood products which are mostly available as at the time the research is conducted are Teak, Ogbeche, Melina and Cinderella in the order of decreasing magnitude. Table 7 shows the analysis, of the respondents' view on the influence of interrelationship among chain members on overall performance of the chain. 30% of the respondents affirmed that security and safety of goods-in-transit are better guaranteed under 3PLS arrangement (a form of SCC) while 35% of the respondents are of the opinion that CS are better taken care of under a SCC arrangement.

Table 8 Roles of extant government policies on SCP

<i>Decision</i>	<i>Absolute frequency</i>	<i>Relative frequency</i>
Strongly agreed	68	46.25
Agreed	31	21.08
Disagreed	15	10.20
Strongly disagreed	33	22.44
Total	147	100

Source: Author's fieldwork 2014

Table 8 depicts the roles, which extant governmental policies have on SCP of wood products. 46.25% of the respondents strongly agreed that such policies aid SCP of wood products while, 21% strongly disagreed.

4.3 Test of hypotheses

To test the hypotheses regression models are formulated for each of the hypotheses. The regression models depict and assess the relationship between a dependent variable and one or more independent variables (Patterson et al., 2003; Nunnally and Durham, 1975). A general linear model is used for multiple regression models, where response Y is related to a set of qualitative independent variables. The general linear model has the following structure (Ott, 2001).

$$Y = B_0 + B_1X_1 + B_2X_2 + \dots + B_{IK}X_{IK} + \xi$$

For this study, the main relationships between dependent and independent variables are thus:

$$1 \quad SCR = b_0 + b_1ROC + b_2JIT + b_3CS + E$$

$$2 \quad SCP = b_0 + b_1FMT + b_2MTX + b_3TCS + E$$

where

b_0 intersection, b_1 , and b_2 = regression coefficients, and ξ = regression error

SCR supply chain relationship

ROC reduction in operational cost

CS customer satisfaction

JIT just-in-time delivery of goods

SCP supply chain performance

FMT forest management techniques

MTX multiple taxes and levies

TCS Timber contractor selection process.

The results of the statistical tests are presented in Tables 9 to 14. By and large, the two hypotheses tested are supported. Findings from empirical evidence provided support for the first hypothesis of this study (H1). The regression model is significant with p value 0.000 (table 9). This result shows that there are relatively strong associations between the proposed factors as explained in the hypothesis. The independent variables (ROC, JIT delivery of goods safely and CS has a positive effect on SCRs). The interrelationship between some of the variables and SCR are already established in extant literature on the discourse. For example, Patterson et al. (2003) found that there is a causal link between the quality of supply chain relationships among constituents of a SC and CS. It is therefore save to posit that, in order to foster sustainable business relationship with SC partners engaged in forestry products in a developing economy, supply chain managers need to engender higher levels of customer's satisfaction, ensure ROC and increase the level of just in time deliveries of products.

Table 9 Model summary

<i>Model</i>	<i>R</i>	<i>R-square</i>	<i>Adjusted R-square</i>	<i>Std. error of the estimate</i>
1	.439 ^a	.193	.175	.56135

Note: ^aPredictors: (constant), CS, ROP, JIT.

Table 10 ANOVA^b

<i>Model</i>		<i>Sum squares</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig.</i>
1	Regression	10.523	3	3.508	11.131	.000 ^a
	Residual	44.116	140	.315		
	Total	54.639	143			

Notes: ^aPredictors: (constant), CS, ROP, JIT.

^bDependent variable: SCR.

Table 11 Coefficients^a

<i>Model</i>	<i>Unstandardised coefficients</i>		<i>Standardised coefficients</i>	<i>t</i>	<i>Sig.</i>
	<i>B</i>	<i>Std. error</i>	<i>Beta</i>		
1 (Constant)	2.394	.366		6.540	.000
ROP	.295	.054	.438	5.417	.000
JIT	.054	.077	.061	.708	.480
CS	-.024	.078	-.028	-.314	.754

Note: ^aDependent variable: SCR.

Table 12 Coefficients

<i>Unstandardised coefficients</i>		<i>Standardised coefficients</i>	<i>t</i>	<i>Sig.</i>
<i>B</i>	<i>Std. error</i>	<i>Beta</i>		
2.560	.928		2.759	.007
.376	.132	.233	2.856	.005
-.306	.141	-.175	-2.164	.032
-.081	.153	-.043	-.528	.598

Note: ^aDependent Variable: SCP.

The second hypothesis is equally supported by the findings (Table 14); extant government policies has a positive effect (p-value => .003) on SCP (better inventory management, higher lead time of product appearance in market, quality of service delivery within the chain). These constructs have been identified and used in measuring SC Performance (SCP) in the literature by different scholars (Stevens, 1990; Quesada et al., 2012). It is therefore safe to posit that government policies on independent variables such as Forest management techniques, TCS processes and system of administering taxes/levies paid by constituents of wood SC has strong effect on SC performance (JIT delivery of products to customers). Most of the respondents are of the opinion that the FMT being employed in running the reserves forest were inherited from the colonial era. Such extant rules are therefore not in tandem with modern day reality. They also opined that taxes and duties levied on members of the chain by various agencies of the government are undermining the growth of the industry. Some of the respondents complained of the bureaucratic bottleneck associated with obtaining of tree inspection certificate (TIC), property hammer (PH), tree permit (TP) and log certificate (LC) which are all prerequisites before a lumber can inspect, harvest and transport harvested log to a saw mill. The process involved appeared cumbersome and laden with corrupt practices. According to the respondents, government officials sometime hide under the guise of conducting due diligence to delay the swift processing of the documents.

Table 13 ANOVA^b

<i>Model</i>		<i>Sum squares</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig.</i>
1	Regression	20.790	3	6.990	4.801	.003 ^b
	Residual	205.278	141	1.456		
	Total	226.248	144			

Note: ^aPredictors: (constant), FMT, MTX, TCS.

^bDependent variable: SCP.

Table 14 ANOVA^b

<i>Model</i>		<i>Sum squares</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig.</i>
1	Regression	20.790	3	6.990	4.801	.003 ^a
	Residual	205.278	141	1.456		
	Total	226.248	144			

Notes: ^aPredictors: (constant), FMT, MTX, TCS.

^bDependent variable: SCP.

The ANOVA table shows the amount of variation in the regression model.

5 Conclusions, managerial implications and limitation

This study is on the assessment of the effect that SCC has on the SC of forestry products in a developing economy. It specifically examined the nature of SCC that exists among constituents of the chain and the effects of such interrelationship on the chain. The study equally examined the role that extant government laws on FMT have on SC of forestry products. Findings from the study indicates that collaborative relationship among chain members engaged in wood SC has significantly reduced operational cost, increased the JIT deliveries of goods and increased customer's satisfaction. It was further revealed that SCC positively influenced by the flow of information and finance among members. The fact that most of the participants in the downstream sector of the chain are centrally located also helped in deepening the interrelationships among members. However, it will be misleading to assume that the level of collaborative activities seen among members of the wood SC in Ibadan is comparable to what is obtainable in a formalised and structured environment.

5.1 Managerial implication and general suggestions

Arising from findings on this study the following managerial and general suggestions are made: there is a need for conscious effort in deepening the knowledge and the inherent benefits in SC orientation, a course advanced by different scholars (Mentzer et al., 2001; Diniz and Fabbes-Costes, 2007). Diniz and Fabbes-Costes (2007) suggest that chain members engaged in SC in developing countries, stand to benefit much by understanding the formalised and structured processes of coordination, cooperation and collaboration of multiple actors in SC. Vertical integration of all chain activities as being presently practiced by most 'Timber contractor' (as revealed by this study) can deepened SCCs among members, conscious efforts must however be made to protect other stakeholders

with small holdings from the expansionist tendencies of some Timber contractors. It is inherently dangerous for the entire 'health' of the chain for much power to be so concentrated in the hands of few players in a developing economy like Nigeria, the ideals of Business Ecosystem Health Theory as espoused by different scholars (Iansiti and Levien, 2004; Hallikas and Varis, 2008), vigorously warned against this, it is a truism that sustainable growth of the chain can be better guaranteed if monopolistic tendencies of some Timber contractors are checked. This can be done by proper regulation of the nature of collaborative relationships among the constituents of the SC. Also, efforts must be made to encourage formalisation of most principal-agent relationships; this should be done through legal documentation of all transactional processes. It will reduce ambiguity in the terms of agreement on operations, risk and profit sharing among the parties. A government regulatory agency should have such oversight function among other similar tasks.

It is imperative also that government play its role as a regulating agency in the management of the forest reserves more transparently. Governmental regulations, when in sync with reality, evidences has shown can enhance chain collaboration among SC operators (Elzarka et al., 2011; Ramanathan et al., 2014).

5.2 Limitations and further research

Some identified limitations of the study include the fact the study is limited to forestry supply chain activities in and around Ibadan, findings from this exploratory study though valid, may not hold true for nature of SCC going on among constituents of forestry products SC in other locations both within Nigeria and in tropical Sub-Saharan Africa. Further research is suggested on assessment of SCC and its effect on the achievement of SCM among constituents of forestry product SC in other developing economies, particularly in some tropical Sub-Sahara African countries where wood products are part of the main source of foreign exchange earnings.

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