PRACTICES AND CHALLENGES OF SUPPLY CHAIN MANAGEMENT BY BUILDING CONTRACTING FIRMS IN THE LAGOS METROPOLITAN AREA

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Nigerian building construction companies face enormous challenges in the management of supply chain which lies at the heart of successful construction project delivery. This paper investigated the challenges of supply chain management by building contractors in the Lagos Metropolitan Area. One hundred building construction companies were sampled out of which seventy two responded to a structured questionnaire. Simple descriptive statistics and factor analysis were the statistical tools used to analyse the data. The result indicated that most building contractors in the Lagos area buy material more locally, they don't have any formal relationships with suppliers, they keep suppliers at close proximity and maintain large inventory of material. The use of modern Information and Communication Technology (ICT) in tracking supplies and inventory management is practically nonexistence. Factor analysis of the major problems of material supply chain indicated six important factors, factor I (import tariff and security agent) factor II (foreign exchange, sharp practices and late delivery) factor III (long lead time and inflation) factor IV (damages and highway robbery) factor V (bad roads) and factor VI (freight cost). The paper recommended that contractors should take more active interest in the material supply end through suppliers' certification and backward integration, apply concept of leanness and modern technology in the management of material supply chain.

Keywords: backward integration, ICT, inventory, material supply chain, suppliers' certification

INTRODUCTION

Supply chain management is no doubt a hot topic in business today, but why is Supply chain management a popular topic these days? The answer is not far fetched, companies are achieving significant competitive advantage by the way they configure and manage their supply chain operations (Chase, Jacobs and Aquilano, 2004). Supply chain management seeks to synchronize a firm's functions and those of its suppliers to match the flow of materials services and information with customers demand. Supply chain management thus has strategic implications because the supply system can be used to achieve important competitive priorities. It essentially involves the coordination of key functions in such areas as marketing, finance, engineering, information systems, operations and logistics. A basic purpose of supply chain management is to control inventory through managing the flow of materials. It is of course important for us to know that inventories exist in three aggregate categories i.e. Raw Material (RW) Work In Process (WIP) and Finished Goods (FG), managing the

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flow of material is common to organization in virtually all sectors of the economy. A typical service provider might spend 30% to 40% of total revenues on the purchase of materials and services. This is more so as many companies today are relying more than ever before on suppliers from around the world. Because material comprises such a large component of sales money, companies can reap large profits with a small percentage reduction in the cost of materials. That is one reason why supply chain management is becoming a major competitive weapon. One area of operations and logistics playing a major role in supply chain management is that of material management, which is concerned with decision about purchasing material and services, inventories, productions levels staffing patterns schedules and distribution (Krajwewski and Ritzman, 1999).

The concern about supply chain management in the construction sector is still a relatively recent phenomenon, although some efforts have been made to widen the understanding of construction supply chain, people in the construction industry – clients, contractors, suppliers and subcontractors are still exploring the concept and practice of supply chain management and how to use it to gain competitive advantage (Arbulu and Ballard, 2004). Views among researchers regarding the scope of supply chain management in the industry are a direct reflection of the way they define it (Hatmoto and Scott, 2006). Construction supply chain management is the management of suppliers, subcontractors, related parties and all processes from delivery information to planning, ordering, producing, delivering and installing material and services for a construction project through a network of organizations (O'Brien and Fisher, 1993).

This paper explored supply chain management issues in the Lagos metropolitan area of Nigeria with the aim of identifying the challenges building contractors face in getting seamless and efficient supply of material inputs. What are the practices and challenges of managing material supply chain by building contractors in the Lagos area?

LITERATURE REVIEW

Supply chain management in construction can be very complex, with hundreds of subcontractors, suppliers involved, especially in a large scale projects (Briscoe, Dainty, A and Millett, 2001). A typical construction supply chain management involves the flow of information (order, schedules, forecast etc) as well as flow of materials (supplies, production and deliveries etc) (Vrijhoef and Koskela, 2000). But Cox and Ireland (2002) in their own submission asserted that construction supply chain management is composed of a material supply chain management, labour supply chain management and equipment supply chain management. Furthermore a reliable flow of work is seen as a critical factor in construction project (Howell, 1999). Any problem with the flow in the supply chain will disrupt the project performance (Hotmoto and Skott, 2006).

Companies across sectors and also within constructions are striving at using supply chain management strategies in order to lever their profitability. Bhote (1989) explained how supply chain management can improve result by reducing the number of suppliers and by creating partnerships for long term relationship, escaping adversarial relationships. Azambuja and Formosa (2003) investigated the design, procurement and installation of elevators in Brazil using supply chain management concept and emphasize that the establishment of partnerships between construction

companies and their designers and elevators manufacturers plays an important role bringing more interaction among the different agents in the early design stages.

In a setting where the two flows of material and knowledge are increasingly intertwined creating value and quality for both customers and enterprisers becomes dependent on the ability to organize and coordinate in the supply chain management (Koch and Larsen, 2006).Quality control in operations in supply chain can be understood as consisting of three types of control for each suppliers; (1) enhanced quality control (2) operational quality control and (3) exit quality control, referring to quality control of inputs, transformation process and output, respectively. In this way it strives to optimize quality in each part of supply network to optimize the total quality of the end product (Deming, 1986; Dale 2003). These means that each part of the supply chain ensures quality of input ensure quality of transformation process and finally ensure quality of the output which is to be delivered to the next part of the supply chain.

Oakland and Marosszeky (2006) emphasized that quality must be integrated in the processes , instead of quality checks of each final product , so it is necessary to define , monitor and control the input to the process , procurement through closer relationship e.g. through supply chain efforts and /or partnering is usually assumed to hold the potential of ensuring the focus on quality in the transformation processes and increasing the knowledge of input quality demand and expectations between the actors in the processes. Supply chain management would reduce the number of suppliers; enable a closer relationship and stability in quality. Supply chain management however tends to focus on dealing contracts on, say, one year delivery. The agreement specifies delivery conditions and states a gross delivery. Quality is moreover specified in general terms. Such contracts of delivery create stability and act as overall governance creating trust and cooperation. They might also be accompanied with stronger communication tools such as web based Information Technology (IT) interfaces between the partners. But they rarely assure the project specific delivery is of the right quality however (Koch and Larsen, 2006).

However, in multi-channel setting like construction, quality concerns multiple material supplies as well as multiple knowledge deliveries. According to Sousa and Voss (2003) integration between channels becomes crucial. Apart from integration issues between channels tensions are created in the delivery, when clients describe their demand not only through the design brief but as a continual process in parallel with design. Similarly the delivery of design is often done piecemeal vis a vis the contractors as a parallel process to construction (Pietroforte, 1997).

LAGOS METROPOLITAN AREA

Nigeria is a sub-Saharan African country with rapidly growing urban centres including the world acclaimed mega city of Lagos. The infrastructural base of Nigeria remained weak, unreliable and obsolete arising from several years of neglect. Power supply remained grossly inadequate and erratic. Transport facilities are poor , as road, rail, air , water and pipeline transport systems are all in state of disrepair (Obadan and Edo, 2004) with serious negative effect on inter and intra city transportation.. The deplorable condition of the economy like many African countries has impeded the ability of the government to properly fund expansion of urban infrastructure and services to match the fast growing urban centres. It must be stated here that Lagos is the former capital of Nigeria and it is the commercial nerve centre of West Africa

apart from being the largest city in the sub region. The megacity of Lagos has emerged as one of the fastest growing megacities in the world with a population of about 10million (NPC, 2006). The city's state of public infrastructure and utilities including transportation (roads), energy and water are in such a deplorable condition. Security situation in the city is terrible with crime rate increasing in alarming proportion. Due to the poor condition of the roads in the metropolis significant man-hours are lost in the ever chaotic traffic system. Building contractors in the city face tremendous amount of challenges in managing their construction project particularly in the area of material supply chain management. The principal problems are associated with the nature of the city's traffic and security situations.

METHOD

Respondents; Respondents were about seventy two (72) building contracting firms operating in the Lagos metropolis. Convenience or accidental sampling technique was adopted for this study. The Respondents were assured of the academic nature of the research and that information volunteered will be treated with absolute confidentiality.

Research instrument; the questionnaire for this study was well structured to obtain reliable and valid data from the respondents. Questions were asked on the broad areas of material supply chain management practices including buying of building material, lead time for material supply, inventory level of material, types of haulage vehicle, supplier's average distance from construction site , contractors' relationship with the suppliers and the major challenges of material supply chain to contractors. Seven types of building materials were selected for the study; these materials include cement, aggregate, reinforcement, blocks, plumbing material, electrical cables and paint. The categories of materials selected were based on the perception of the researchers on the importance of the materials to building contractors. A preliminary survey for validating the research instrument was done a month before the final field work was carried out. About 12 final year students of the department of quantity surveying were recruited for the fieldwork.

RESULT

Analysing strategy; the data obtained from the fieldwork were analysed using descriptive statistics e.g. measurement of central tendency (mean, median, and mode,) dispersion (variance and standard deviation) and frequency, factor analysis was used to analyse the major problems of material supply chain. Factor analysis is often used in data reduction to identify a small number of factors that explains most of the variance in a much larger number of manifest variables (Chisnall, 2001). All statistical analyses were performed with SPSS version 13.

Predeliberation individual measures
Analysis of the material buying practices of contractors showed that aggregate (51.4%) block (52.9%) are predominantly bought locally (site office) from suppliers around construction site. Electrical cables (45%) is bought centrally (head office) while cement (51.4%) reinforcement(45.7%) are hybrid of both local and central buying and lastly plumbing (42.9%) and paint(38.6%) showed equal frequency between local and central buying. (See Table 1).

Analysis of average lead time for material suppliers showed that cement have an average lead time of 11-15days, aggregate 6-10days, reinforcement 11-15days, blocks

1-5days, plumbing material 6-10days, cable 6-10days and paint 6-10days (see Table 2).

Analysis of practices of inventory level of material showed that cement(74.3%) and reinforcement (62.9%) are held in large inventory, aggregate (58.6%) and block (60%) are held in buffer inventory while plumbing material(52.9%) and cable (51.4%) are held in zero inventory(see Table 3).

Analysis of type of haulage vehicle used for selected building materials showed that articulated lorry (60%) is used to haul cement, lorry/truck(90%) is used to haul aggregate, articulated lorry(55.7%) is also used to haul reinforcement, blocks is hauled by lorry (67.1%), pick up van is used to haul cables (84.3%) plumbing material(85.7%) and paint(75.7%) (See Table 4).

Analysis of material suppliers' distance from construction sites showed that the average distance of all selected material suppliers distance from construction site is between 6-10km with percentage score of 30% for cement, 28.6% for aggregate suppliers', 27.1% for reinforcement, 41.4% for block, 34.3% for plumbing materials and 42.9% for cable. However, only paint suppliers have an average distance of 11-15km with a percentage of 34.3 %(see Table 5).

Analysis of the type of relationship between contractors and selected material suppliers showed short term contract relationship for cement suppliers (60%) no formal relationship for aggregate suppliers (97.1%) reinforcement suppliers (68.6%) block suppliers (65.7%) plumbing material suppliers (92.9%) cable suppliers (98.6%)and paint suppliers (94.3%)(see Table 6).

Table 1: Buying of building material

	Cement	Aggregate	Reinforcement	Blocks	Plumbing	Cable	Paint
Local	8.6%	51.4%	22.9%	52.9%	42.9%	34.3%	38.6%
Central	40.0	25.7	31.4	31.4	42.9	45.7	38.6
Hybrid	51.4	22.9	45.7	15.7	14.3	20	22.9

Table 2: Lead time for supply of selected material

	Cement	Aggregate	Reinforcement	Blocks	Plumbing	Cable	Paint
21 -25days	5.8%		2.9%	-	-	-	-
16 -20days	7.2	1.4%	8.6	-	-	-	-
11 -15days	39.1	21.4	40	10%	24.3	17.1	17.1
6 -10days	34.8	37.1	38.6	41.4	58.6	68.6	57.1
1 -5days	13	40	10	48.6	17.1	14.3	22.9

Table 3: Inventory level of material

	Cement	Aggregate	Reinforcement	Block	Plumbing	Cable
Large inventory	74.3%	7.1%	62.9%	4.3%	2.9%	2.9%
Buffer inventory	21.4	58.6	31.4	60	44.3	42.9
Zero inventory	4.3	34.3	5.7	35.7	52.9	51.4

Table 4: Types of haulage vehicle

	Cement	Aggregate	Reinforcement	Block	Plumbing	Cables	Paint
Articulated lorry	60%	4.3%	55.7%	1.4%	-	-	-
Lorry	24.3	90	30	67.1	2.9	2.9	5.7
Bus					10	8.6	15.7
Pick up van	15.7	4.3	12.9	31.4	84.3	85.7	75.7
Car		1.4	1.4		2.9	2.9	2.9

Table 5: Suppliers' distances from construction site

	Cement	Aggregate	Reinforcement	Blocks	Plumbing	Cable	Paint
0-5km	7.1%	21.1%	1.4%	22.9%	2.9%	2.9%	2.9%
6-10km	30	28.6	27.1	41.4	34.3	42.9	32.9
11-15km	17.1	17.1	24.3	11.4	31.4	35.7	34.3
16-20km	18.6	15.7	21.4	14.3	17.1	4.3	18.6
Above 20km	27.1	11.4	25.7	10	14.3	14.3	11.4

Table 6: Relationship with material suppliers

	Cement	Aggregate	Reinforcement	Block	Plumbing	cable	Paint
No formal relationship	40%	97.1%	68.6%	65.7%	92.9%	98.6%	94.3%
Short term contract	60	2.9	28.6	1.4	7.1	1.4	4.3
Long term contract	-	-	1.4	-	-	-	1.4
Full ownership	-	-	1.4	32.9	-	-	-

A look at descriptive statistics of the different problems of material supply chain management indicated that the most important single problem militating against flow of material is bad road (M=4.80) and the least important of the problems is long lead time (M=2.40) (see Table 7).

The SPSS output of the factor analysis of the 14 major problems of material supply chain management indicated six broad categories of the important factors with different loadings of the 14 original factors. Factor 1 loaded heavily on import tariff (.786) and security agents (.731), factor 2 loaded heavily on foreign exchange rate (.769) , sharp practices (.662) and late delivery (.627), factor 3 loaded heavily on long lead time(.725) and inflation(.647), factor 4 loaded heavily on damages (.747) and highway robbery (.709), factor 5 loaded heavily on bad road (.856) only and lastly factor 6 loaded heavily on freight cost (.753) only (See Table 8).

Table 7: Descriptive statistics of problems of supply chain management

Problem	Mean	Std. Deviation	Analysis N
Bad road	4.80	.403	70
Cash flow problem	4.76	.523	70
Sharp practices	4.66	.679	70
Late delivery	4.60	.522	70
Supplier failure	4.50	.631	70
Foreign exchange	4.16	.879	70
Inflation	3.23	.935	70
Damages	2.96	.908	70
Highway robbery	2.60	.730	70
Freight cost	2.60	.689	70
Import tariff	2.51	.794	70
Insurance cost	2.44	.605	70
Security agents	2.43	.579	70
Long lead time	2.40	.646	70

Table 8: Rotated component matrix of supply chain problems

Problem	Factors					
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
Import tariff	.786		.179	.104		
Security agents	.731		.110	.130		.146
Foreign exchange		.769	.121		-.139	
Sharp practices		.662				-.496
Late delivery		.627	-.112	.282	.404	
Supplier failure	-.315	.493	.136		-.197	.428
Long lead time	.205		.725	-.171	-.117	.185
Inflation	.164		.647	.120	.485	
Cash flow problem	-.540		.559	.464	.124	
Insurance cost	.457		.510	.187	-.319	-.320
Damages		.235		.747		.116
Highway robbery	.167	-.187		.709	-.148	
Bad road				-.108	.856	
Freight cost	.270			.111		.753

DISCUSSION

The study of supply chain management in Lagos, Nigeria and in most developing countries is relatively new, more so in the construction sector which is dismally under researched in this part of the world. There is virtually no any known past published study of construction firms' supply chain management in Nigeria before now. This study is an attempt to take up the challenge of understudying the strategies of Nigerian building contractors in managing the supply of a very critical construction resource – material. The fundamental issue in supply chain management is the integration of parties in a project as a way ensuring seamless flow of material inputs (Dainty, Briscoe and Millett, 2001). However, the peculiar nature of the Lagos operations environment implies significant challenges in achieving such objectives.

The result of the analysis of material buying showed that most construction material are bought locally or hybrid of local and central buying, this is plausible due to the chaotic condition of roads and transport system of the Lagos metropolitan area. However, electric cable is unique because it is the only material that is bought centrally through the head office, this is probably due to the fact that electric cables are non perishable and bought once or few occasions in most building project.

The result also showed that the lead time for most selected material is between 1 and 15 days. In the Lagos metropolitan areas material suppliers are aware of competitors and are striving to reduce lead time because of its implications for continue business relationship with building contractors.

The result of analysis of data on inventory level of material showed that most contractors in the Lagos metropolitan area prefer large inventory of cement (74.3%) and reinforcement (62.9%) this may be due to the relative uncertainty and difficulty in sourcing for replenishment during certain critical periods as reinforcement and the bulk of cement are imported into Nigeria. The result also indicated that aggregate (58.6%) and blocks (60.0%) are kept at buffer inventory , this is may not be unconnected with the relative ease of sourcing for new supply at any particular time of the year both aggregate and blocks are sourced and processed locally within the metropolis or from nearby quarries. However, plumbing material (52.9%) and

electrical cables (51.4%) are kept by building contractors in the metropolis in zero inventories. Service materials i.e. plumbing and electrical cables are not what the contractor buy every time and suppliers of these materials seldom disappoint at time of needs.

Analysis of data on types of haulage vehicles indicated that articulated Lorries or tractor trucks are used in hauling bulky materials like cement (60%) and reinforcement (55.7%) these materials are kept in large inventory, other vehicle can hardly be economical in hauling these materials. Lorry or trucks are the preferred vehicle for hauling aggregate (90%) and blocks (67.1%) this is probably because of the fact that these materials are kept in buffer stock and bought almost everyday at peak period; Lorries therefore provide a relative economy of haulage. Pick ups and vans are used in hauling plumbing materials (84.3%) electrical cables (85.7%) and paints (75.7%) this may be due to the relative lightweight natures of these materials and the fact that they are supplied in relatively small quantity at a time.

Result of suppliers' distance from construction site indicated that most suppliers of selected materials are located at between 5 and 10 km from construction site. Suppliers distance could be critical in material supply chain management considering the chaotic transport system in Lagos with almost traffic jam, bad roads and man-hour loss on roads during haulage.

Analysis of data on the types of relationships contractors have their material suppliers indicated that most building contractors in Lagos metropolitan area maintain no any special relationship with their suppliers, viz aggregate (97.1%) reinforcement (68.6%) block (65.7%) plumbing (92.9%) cables (98.6%) paint (94.3%), but contractors maintain short term contract with cement suppliers (60%). The lack of formal relationship with supply is a clear indication of the lack of awareness of the critical role of supply chain in seamless construction project execution. The short term relationship with cement suppliers indicates the importance that contractor placed on cement and the relative uncertainty in the supply of the material.

Analysis of data on problems of building contractors' supply chain in the Lagos metropolitan area indicated the most important is bad roads (Mean $\underline{M}$=4.80) and the least problem is long lead time ($\underline{M}$=2.40). Most of the problems reflect the difficult operating or business environment of Nigeria particularly Lagos metropolis. The problems can be easily linked to poor infrastructure [bad roads(4.8)] economic environment [import tariff(2.51) inflation(3.23) foreign exchange(4.16)] corruption [sharp practices(4.16) security agents(2.43)] suppliers' reliability [late delivery(4.60) suppliers' failure(4.50) long lead time(2.40)] crime rate [highway robbery(2.60)] high cost [damages(2.96) freight cost(2.60) and insurance cost(2.44)] and client payments [cash flow problem(4.76)]. All the problems of identified as bedeviling material supply chain are basically fundamental to virtually all the sectors of the Nigerian economy. The socio-economic environment is highly unstable with poor infrastructure (Obadan and Edo, 2004) and pandemic corruption even among security agents and law enforcement officers.

CONCLUSION

The study has shown that the management of material supply chains by building contracting companies in the Lagos metropolis taking the most practical approach to source for material for their construction works. Most contractors are not creative in the managing material supply chain probably because of the lack of research works in

supply chain in the Nigerian environment. For example except for cement supply, contractors don't have formal relationships with their suppliers. There is obvious case of lack comprehensive and value enhancing approach to supply chain issues by most building contractors in the Lagos area this could be easily discernible from the relative newness of supply chain management in the Nigerian construction sector.

Most material suppliers are located at close proximity to construction sites because of bad and chaotic traffic situation in the Lagos metropolis. Very important building materials like cement and reinforcement are held in large inventory while relatively less important materials are kept in buffer inventory. There are several problems or challenges militating against smooth material supply chain management, the most important among them being bad roads, cash flow problems, sharp practices and late delivery etc.

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