



ASSESSING THE EFFECTIVENESS OF INTRA-FIRM SUPPLY CHAIN INTEGRATION PRACTICES OF CONSTRUCTION FIRMS IN NIGERIA

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Abstract

The ultimate aim of supply chain integration is to achieve effective external integration between firms in a supply chain, and the starting point for this broad integration is intra-firm integration. However, the extent to which functional units/departments integrate within and amongst them and the effectiveness of the integration is not fully understood. This paper reports the results of a study carried out in three purposively selected large construction organisations that operate at national level, with the aim of assessing the extent of, and the effectiveness of their intra-firm integration. Descriptive statistics was used to analyse the data collected across the three organisations. Findings indicated that every department engaged in internal integration practices (communication and information sharing, coordination and resource sharing, and organisational relationships) in varying proportions, and the effectiveness of the practices equally varied amongst the departments. 47% of the departments indicated that the extent of integration within and between them was high and effective, 22% indicated a moderate level and somewhat effective integration, while 31% indicated that the extent of their integration was low and ineffective. It is concluded that internal integration, when effectively done within and across functional units and departments, would enhance the internal operational efficiency and the external integrative capabilities that would increase competitive performance of organisations.

Keywords: Departments, External integration, Internal integration, Internal integration practices, Supply chain integration.

1.0 INTRODUCTION

The importance of Supply Chain Integration (SCI) in enhancing operational performance has been widely reported in the literature [1], [2]. [3] observed that SCI is often justified on the basis that the entities of a supply chain should work holistically, rather than each entity optimising its own well-being. It is this idea of a holistic working that has seen organisations delve into various supply chain practices that cut across functional, departmental and organisational boundaries with a view to enhancing overall performance. SCI exists either as internal integration concerned with collaboration, coordination and integration of operational areas within an organization [4], or external integration; concerned with a firm's inter-organisational strategies, practices and processes in a collaborative and synchronized way [5].

Extant studies abound that support the idea that a firm's ability to 'put its own house in order' before strengthening relationships upstream and downstream in the supply chain is key to achieving effective external integration [6] [7] [8]. That is, internal integration should first be achieved before external integration [4]. Hence, the importance of internal integration is therefore not in doubt. However, what appears to be lacking in the extant literature are studies that examine the extent to which functional units/departments integrate within and between them, and the effectiveness of such integration. Thus, this study attempts to fill-in this gap by looking beyond the dyadic levels as often done by past researchers, and considers a firm-wide cross-functional integration between the various units within an organisation. Going beyond the dyadic level within a focal firm will

increase our understanding of the degree to which firms engage in practices of internal integration and the effectiveness of such practices, and will help managers in identifying areas that need improvement.

1.1 Literature Review

1.1.1 The concept of supply chain integration

Supply Chain Integration (SCI) is defined as the development of operational and strategic intra and inter-firm cooperation and collaboration along the supply chain with the objective of achieving enhanced productivity and performance [6]. The aim of SCI is to accomplish effective and efficient flows of products and services, information, money and decision in order to provide the best value for customers at a lower price and with higher speed [9]. The key thrusts of SCI include, among others, collaboration, shared decision making, open communication, shared vision, shared technology and high level of trust among the collaborating chain members.

From a resource-based view, firms that integrate along the supply chain can acquire transaction-specific know-how and improved efficiency and coordination to achieve competitive performance in areas such as cost, quality, flexibility and delivery [10], [4]. Thus, integration can help effectively manage inter-functional relationships and conflicts and increase inter-functional effectiveness. This effectiveness can facilitate strategy implementation that results in better performance [11]. Two types of integration strategies have generally been considered in the literature: external integration and internal integration.

1.1.2 External integration

External integration refers to the integration of a focal company with its external environment including customers (clients) and suppliers [2]. It aims at overcoming the individual company boundaries to an overall supply network integration. Several studies have found a positive relationship between external integration and organisational performance. For instance, integrating externally with customers improves customer satisfaction by reducing a firm's product design and production planning time [12], [1]. Similarly, supplier integration has also been found to be related to product development performance [13], supplier communications performance [14] and improved competitiveness [15]. It suffices to say that given an effective external fit between firm's organisational structure and the integration strategy it pursues in response to its external environment, customer and supplier integration are positively related to a firm's operational performance.

1.1.3 Internal integration

Internal integration is about collaborating, coordinating and integrating the operational areas within an organisation so that they function as an interrelated process with a view to attaining overall organizational goals [16]. Studies have argued that a well-integrated internal supply chain should result in excellent service and company performance [17], [18]. For instance, [19] found that internal collaboration can bring about inter-departmental cohesion which facilitates strategy implementation, resulting to better performance. Cross-functional interactions facilitated by mutual understanding, high degrees of information sharing and knowledge transfer amongst functions have been found to lead to better and speedier decisions, which in turn, enhance operational performance [6].

Arguing from an organisational capability perspective, researchers [6], [20], [5] have consistently posited that internal integration is a prerequisite to external integration. They argue that a high level of communication, coordination, information and resource sharing capabilities together with effective relational linkages within an organisation are needed if a firm is to be capable of absorbing the external uncertainties and linkages that are necessary for external integration to occur. Hence, companies with a low level of internal integration will less likely have adequate capability to integrate with external partners, whereas companies with high levels of internal integration are in a better position to integrate externally [5].

Despite the plethora of studies supporting the importance of internal integration, extant studies appear to be saying little about the extent to which functional units/departments within the boundaries of a firm integrate amongst them, and how effective such integrations are in laying effective foundation for external integration across a firm's boundaries. Expounding on the extent and the effectiveness of internal integration within a focal firm will increase our understanding of the degree to which construction firms engage in practices of internal integration and will help managers in identifying areas for improvement.

1.2 Measurement of Integration

While the basic concept of internal integration may be familiar, the actual operationalisation and measurement of the concept is largely determined by a researcher's choice and the research perspective [21]. For example, [22] propose five dimensions of integration namely; communication and information

sharing, coordination, organisation, collaboration and shared decision-making, and operational and strategic collaboration. [23] came up with three categories of integration— attitudes, patterns and practices – which, due to their contents, [3] suggests to coincide with dimensions of integration, namely; the relational dimension, collaboration and interaction. Another set of dimensions suggested by [4] are information integration, material integration, financial integration, technological integration and actors' integration. However, information integration, co-ordination and resource sharing, and organisational relationship linkages appear to be the most concise and comprehensive dimensions among others [23]. Hence, this study uses these dimensions to operationalise and measure internal integration within organisations.

1.2.1 Information integration

Effectively shared information provides the linkages that are used to forecast and synchronise all activities across the supply chain [24]. It then follows that, the extent to which operational, tactical, and strategic information are shared along a supply chain is a good barometer of how effective the various production processes along the supply chain are, and the areas that need improvement.

1.2.2 Coordination and resource sharing

Supply chain coordination primarily emphasises seamless process connections and synergies along the supply chain. The main objective of supply chain coordination is to coordinate the independent players to work together as a whole to pursue the common goal of chain profitability at all times. Supply chain coordination encourages mutual trust, efficient operational planning, conflict resolution and the sharing of information, and provides both operational and strategic benefits [6]. Hence, measuring and knowing the extent and effectiveness of coordination and resource sharing along a supply chain will give a good indication of how well the organisational, and ultimately, the overall supply chain goals can be effectively achieved.

1.2.3 Organisational relationship linkages

Organisational relationship linkage is concerned with fostering close formal and informal relationships based on mutual trust and understanding between supply chain members [4]. It is represented by collaborations and cooperation through cross-functional teams, joint planning, goals sharing and the adoption of common vision among the functional units with a view to increasing inter-functional

effectiveness and performance [20]. When a firm lacks cross-functional integration, allowing for people to work within their own functional silos, processes within the firm will be fragmented and disconnected. Under such circumstances, the firm is less likely to plan well for its own activities, and hence, is more likely to lack the capability to resolve potential conflicts, set up synchronised processes, and facilitate production with other chain members [6].

2.0 METHODOLOGY

2.1 Data Collection Technique

Since the purpose of the study is to uncover the extent and the effectiveness of internal integration within and between departments in an organisation, the research technique therefore requires a plan that will allow for the perceptions of all employees responsible for the different value creating processes within and between departments in an organisation to be studied. To achieve this, a multiple case study design was adopted that allowed the perceptions of all the employees in all departments to be captured, aggregated and reported at organisational level. Following recommendation by [25] that no more than four to five cases be selected, three large construction firms with turnovers of over ₦500 million, and are big enough in terms of size, complexity, and diversity, and have organisational structures that comprised distinct functional departments were purposively selected. To facilitate easy capture of all the employees' perceptions, a structured, close-ended questionnaire was administered to all full-time employees that normally partake in the daily operational activities, and who are believed to be adequately familiar with the internal operational and tactical issues within and between departments, and perhaps, at organisational levels. Section A of the questionnaire consisted of questions gathering personal and organisational profile information. Section B consisted of questions developed based on the three constructs of internal integration (communication/information sharing, coordination and resource sharing, organisational relationship linkages) derived from the literature review. In all, twenty-nine items that represent internal integration practices were presented to respondents to indicate their agreement on the extent to which they were practised in their departments. The respondents were asked to score their opinions on a five-point Likert scale ranging from 5: practised to a very high extent, to 1: practised to a very low extent. The questionnaires were self-administered to all workers in all the departments across the three organisations studied.

2.2 Data Analysis Technique

The data obtained were analysed with the use of IBM SPSS (version 25.0) software. Frequencies, means and standard deviations were computed. To measure the extent of internal integration, classification scheme developed by [26] of 'full', 'moderate' and 'no' integration was suitably adapted to classify integration within departments into 'high', 'moderate' and 'low' level. To achieve this classification, the overall mean scores [27] of the three constructs of integration were computed for each department. If a department obtained an overall mean score of at least 3.0 on a scale of 5 in all the three constructs of integration, the department was classified as having a 'high' level of integration. If an overall mean score of at least 3.0 was obtained in any one or two of the constructs, the department was classified as having 'moderate' level of integration. However, if the overall mean score obtained was less than 3.0 on all the three constructs of internal integration, the department was classified as having 'low' integration.

A thorough search of the literature appears to indicate that the methods and units of objectively measuring and assessing the effectiveness of integration practices have not been established. Therefore, a subjective measure was deemed appropriate for use as a surrogate measure of the effectiveness of the integration practices. Subjective measures have been widely used as surrogate measures of actual effectiveness of systems or practices in organisations [28], [29]. Hence, the effectiveness of the integration practices was measured by peering through the lens of the extent of integration attained by a department. If the extent of integration of a department was high, the integration practices were considered 'effective'. If the extent of integration was moderate, then the integration practices were considered to be 'somewhat effective'. However, where the extent of integration was low, then the department's integration practices were said to be 'ineffective'.

3.0 RESULTS AND DISCUSSION

The data presented herein were collected from three large civil engineering construction companies that work across Nigeria. Their organisational structures are comprised of distinct functional departments and units. Table 1 presents the demographic information of the companies.

As recommended by [30] that the validity and reliability of data be checked to ascertain their accuracy, content validity was first established through an iterative construct review by experts following a careful search and synthesis of the

literature. Internal consistency and reliability of the constructs of internal integration were then determined using the Cronbach's alpha. Alpha values ranging between 0.72 and 0.86 were obtained. These values were deemed adequate as they have all passed the recommended threshold of 0.70 by [31]. Further reliability was ascertained by evaluating the inter-rater agreement between the respondents. Inter-class correlations of at least 0.64 were obtained. This further indicated a good reliability.

Table 1: Cross-case comparison of the demographics of the companies

S/N	Demographics	CASE A	CASE B	CASE C
1	Year of establishment	1974	1979	1982
2	Annual turnover	Over N500million	Over N500million	Over N500million
3	Number of departments	9	7	9
4	Number of employees	383	295	330
5	Nature of business	Civil engineering works and sales of construction materials	Civil engineering works	Civil engineering works and plant hiring services

Source: Field survey (2021)

3.1 Results

Results of the analysis of the extent and effectiveness of internal integration within the departments of the three companies are hereunder presented. However, for brevity, detailed results of one department from Case A are presented in Table 2, and a summary of the results of the others is given in Table 3.

Table 2: Extent of internal integration in Department of Engineering

A	Communication / information sharing	Mean	Standard deviation
1	My department encourages effective sharing of operational information.	3.56	1.18
2	My department encourages frequent communication of goals and priorities.	3.53	1.56
3	My department encourages effective sharing of performance-related information.	3.47	0.99
4	My department encourages effective sharing of logistics-related operating data.	3.18	1.11
5	My department encourages effective sharing of planning-related operating data.	3.10	1.40
6	My department encourages unit head and other workers to communicate effectively with one another.	3.07	1.12
7	My department encourages data sharing and integration in production process.	3.05	1.18
8	My department encourages effective sharing of procurement-related information.	2.98	1.68
9	My department encourages effective utilisation of integrated database and access method to facilitate internal information sharing.	2.97	1.26
10	My department encourages effective sharing of design-related information.	2.87	1.32

11	My department encourages effective communication of information about specific internal processes to facilitate other related processes.	2.85	1.19
12	My department encourages effective sharing of inventory-related operating data.	2.79	1.28
13	My department encourages following of proper channels of communication	1.96	1.10
Overall mean		3.03	
B	Coordination and resource sharing	Mean	Standard deviation
14	My department encourages efficient coordination of the flow of materials.	3.87	1.02
15	My department encourages efficient coordination of the flow of other resources such as knowledge, finances, services, etc.	3.45	1.24
16	My department encourages effective use of integrative inventory management.	3.40	0.83
17	My department encourages effective coordination of operational activities.	3.40	1.18
18	My department encourages efficient coordination of logistics operations.	3.35	0.85
19	My department encourages effective alignment of systems and controls.	3.21	0.78
20	My department encourages synchronisation of processes and operations.	2.33	0.98
Overall mean		3.29	
C	Organisational relationship linkages	Mean	Standard deviation
21	My department encourages effective use of cross-functional teams in executing projects.	3.60	1.16
22	My department encourages periodic inter-departmental meetings among internal functions.	3.49	0.92
23	My department encourages frequent use of informal face-to-face meetings.	3.47	0.92
24	My department encourages development of a mutual understanding of responsibilities.	3.33	1.11
25	My department encourages joint planning and cooperation to resolve conflicts.	3.27	1.22
26	My department encourages the use of reward systems to enhance internal integration.	3.21	1.12
27	My department encourages openness and maintenance of a good working relationship with each other	3.06	0.91
28	My department encourages joint consideration of issues and decisions within the functional unit.	2.99	0.99
29	My department encourages the use of a liaison personnel whose job is to coordinate the efforts of workers.	2.88	1.10
Overall mean		3.26	

Source: Field survey (2021)

Table 2 presents the analysis of the extent to which practices that signify internal integration are practised in the Department of Engineering. Starting with communication/information sharing, the table shows that the extent to which “sharing of operational information” is practised is ‘high’ with a mean of 3.56. This is followed by “frequent communication of goals and priorities” with mean of 3.53. “Sharing of performance-related information” is also practised to a ‘high extent’ with a mean of 3.47. The practices that are practised at a ‘moderate extent’ are

“communication of information about specific internal processes to facilitate other related processes” and “sharing of inventory-related operating data” with means of 2.85 and 2.79, respectively; while “following of proper channels of communication” is practised at a ‘low extent’ with a mean of 1.96. The table further shows that the overall extent of the practice of communication/information sharing is ‘high’ with an overall mean of 3.03.

With respect to the extent to which the second construct of internal integration – coordination and resource sharing is being practised; Table 2 indicates that “coordination of the flow of materials” is practised at a ‘high extent’ with a mean score of 3.87. This is followed by “coordination of the flow of other resources such as knowledge, finance, and services” with a mean of 3.45. The third practice that is performed at a ‘high extent’ is “use of integrative inventory management” with a mean of 3.40. Other practices that are performed at a ‘high extent’ include “coordination of operational activities”, “coordination of logistics operations” and “alignment of systems and controls” with mean scores of 3.40, 3.35 and 3.21 respectively. Overall, the extent of the practice of coordination and resource sharing is ‘high’ as indicated by an overall mean score of 3.29.

Similarly, Table 2 shows the extent to which the third construct of integration – organisational relationship linkages is practised within the department. The table indicates that the “use of cross-functional teams in executing projects” is practised at a ‘high extent’ with a mean score of 3.60, followed by “periodic inter-departmental meetings among internal functions” with a mean score of 3.49. “Frequent use of informal face-to-face meetings” is also practised at a ‘high extent’ with a mean of 3.47. “Use of a liaison personnel to coordinate the efforts of workers” and “joint consideration of issues and decisions within the functional unit” are practices that are performed at a ‘moderate extent’ with means of 2.88 and 2.99 respectively. The overall extent of the practice of organisational relationship linkages is high with an overall mean score of 3.26.

Since the Department has obtained an overall mean score of at least 3.0 on all the three constructs of internal integration, the Department is classified as having a ‘high’ level of internal integration. Equally, since the extent of integration of the department is high, the internal integration practices within the department are ‘effective’.

Table 3: Summary of cross-case comparison of the extent of, and effectiveness of integration within Departments

CASE A						
S/N	Department	Comm./info sharing	Coord. & resource sharing	Relational linkages	Extent of integration	Effectiveness of integration
1	Central administration	2.71	2.56	2.75	Low	Ineffective
2	Finance and Accounts	2.84	2.45	2.64	Low	Ineffective
3	Maintenance & engineering	3.07	2.55	1.91	Moderate	Somewhat effective
4	Transport and logistics	2.31	3.01	2.11	Moderate	Somewhat effective
5	Construction plant and equipment	3.17	3.48	3.51	High	Effective
6	Projects Procurement and management	3.10	3.57	3.51	High	Effective
7	Technical services	3.04	3.06	3.01	High	Effective
8	Purchasing & supplies	3.04	3.06	3.01	High	Effective
CASE B						
S/N	Department	Comm./info sharing	Coord. & resource sharing	Relational linkages	Extent of integration	Effectiveness of integration
1	Administration	2.78	2.74	2.66	Low	Ineffective
2	Accounts	2.69	2.71	2.70	Low	Ineffective
3	Human resources	2.77	2.76	2.79	Low	Ineffective
4	Transportation	2.88	3.00	3.12	Moderate	Somewhat effective
5	Mechanical plant and equip't	2.81	2.78	3.02	Moderate	Somewhat effective
6	Engineering	3.52	3.66	3.61	High	Effective
7	Project Procurement	3.58	3.65	3.69	High	Effective
CASE C						
S/N	Department	Comm./info sharing	Coord. & resource sharing	Relational linkages	Extent of integration	Effectiveness of integration
1	Security	2.73	2.83	2.60	Low	Ineffective
2	Finance and supplies	2.73	2.94	2.68	Low	Ineffective
3	Mechanical plant and equip't	2.91	2.70	2.47	Low	Ineffective
4	Managing Director's office	2.79	2.82	2.61	Low	Ineffective
5	Administration	3.08	2.90	2.84	Moderate	Somewhat effective
6	Engineering and services	3.48	3.64	3.62	High	Effective
7	Projects and Procurement	3.48	3.55	3.58	High	Effective
8	Maintenance	3.63	3.71	3.66	High	Effective
9	Transport and logistics	3.61	3.69	3.67	High	Effective

Source: Field survey (2021)

From the summarised results of the other departments across the three Cases as presented in Table 3, it can be seen that in Case study A, two departments have low levels of integration, and hence, 'ineffective' internal integration, another two have moderate levels of integration thus indicating a 'somewhat effective' internal integration, while the remaining four have high levels of internal integration, thus signifying 'effective' integration practices. In Case study B, three departments have low levels of internal integration thereby indicating 'ineffectiveness' in their integration practices, another two have moderate levels of integration which suggests a 'somewhat effective' internal integration practices, while two other departments have high levels of integration internally which indicates 'effective' integration. Similarly, in Case study C, four departments have low levels of integration suggesting ineffectiveness in their internal integration, one department has moderate level integration, thus signifying a 'somewhat effective' internal integration, while four departments have high levels of integration internally which indicates 'effective' internal integration. From

the above results, it can be understood that every department has its own level of internal integration, with some having better levels of integration than others.

Deriving from the results, since the extent of integration within departments in case study A is higher than what obtains in each of cases B and C, it can be inferred that case A is more internally integrated than cases B and C. It is however worth mentioning that the extent of integration in case C is more than what obtains in case B. The results equally mean that the integration practices of case A are more effective than the integration practices of cases B and C. This goes to suggest that case A is more internally integrated than C and case C is more internally integrated than case B.

A further look at the results obtained by each department under the three constructs of integration in case study A, indicated that the level of communication/information sharing and coordination and resource sharing was higher than what obtained in

the organisational relationship linkage. Similar trend was observed in case study C. However, in case B, the level of integration was higher for coordination and resource sharing and organisational linkages than it was for communication/information sharing. This suggested that companies A and C favoured the use of communication/information sharing and coordination and resource sharing in their internal integration practices. Reasons for this may not be unconnected with their organisational structures, cultures and even possibly, their policies. However, expounding on this is beyond the scope of this paper.

The results further showed that the extent of integration practices within departments across the three organisations and indeed the effectiveness of such integration practices differed between departments, and by extension, between organisations. For instance, the extent of integration in the Departments of Administration and Finance/Accounts across the three companies was low. This signified that internal integration practices in these two departments across the three organisations were ineffective. However, the results contrasted with what obtained in the Departments of Engineering and Projects/procurement that had high levels of internal integration within them across the three organisations. These differences in the extent of, and effectiveness of the internal integration practices could be indicators of functional units working at cross-purposes which could lead to low levels of organisational performance.

3.2 Discussion

The findings generally suggested that the effectiveness of internal integration was influenced by the level of integration attained. In essence, as the level of integration increased from low to high, the effectiveness of the integration practices also increased from ineffective to effective. Since performance could be looked at from the point of view of effectiveness because it is an indicator of how well a system or a practice achieved organisational goals [32], it is argued that the departments that have effective supply chain integration would contribute more to the general performance level of their organisations because they have high levels of internal integrative capability. This submission favourably aligned with the conclusion of [18] and [33] that well-integrated internal supply chains should result in excellent services that could have great influence on company performance.

Findings equally indicated that the dimension of integration most practised across the three companies was coordination and resource sharing, followed by information/communication sharing and lastly organisational relationship linkage. This finding is not surprising because studies such as [6] and [33] have submitted that supply chain coordination encourages mutual trust, efficient operational planning, conflict resolution, and the sharing of information, and provides both operational and strategic benefits. However, this finding is not to suggest that communication/ information sharing is not equally important because studies exist that posited that the basic foundation for close coordination and collaboration in supply chains is information integration amongst supply chain members [23], [5], [3].

Considering that supply chain integration is predicated on the holistic working of the chain members to attain organisational goals [3], the ineffectiveness of the integration practices exhibited by some departments is a tacit indication that such departments' level of contribution to the organisational goals leaves a lot to be desired. Since the effectiveness of a system or practice helps to assess the progress towards mission fulfilment and goal achievement [34], it is argued that the ineffectiveness observed concerning the internal integration practices of some departments could be an indication that some departments are working at cross purposes with others. In this sense, rather than the organisations' functional units working as 'an integrated whole', they are rather working as functional silos based on their traditional departmentalisation and specialisation. This position agreed with the submission of [6] that silo mentality born by the traditional departmentalized organisational structure common in construction organisations breeds ineffectiveness in the various value-creating operational activities both at operational and tactical levels. The implication of this is that operational efforts that could lead to improved quality and efficiency in the production process would be hampered or constrained such that both strategic and operational performance are affected.

4.0 CONCLUSION

The purpose of the study was to uncover the extent and the effectiveness of internal integration within and between departments in construction organisations. To this end, questionnaires were administered to all full-time employees of three selected large

construction companies that work across Nigeria with a view to obtaining their perceptions on the subject matter. It was found that the extent of integration practices within departments across the three organisations and indeed the effectiveness of such integration practices differed between departments, and by extension, between organisations. It was also found that the effectiveness of the integration practices was a function of the level or extent to which the integration practices were performed. The higher the level at which departments collaborated, cooperated, related, communicated and shared information, the more effective their internal integrations were, and the more capable would the organisations be at effectively integrating with external chain members. It is concluded that internal integration, when effectively done within and across functional units and departments, would enhance the internal operational efficiency and the external integrative capabilities that would increase competitive performance of organisations. It is recommended that organisations wishing to improve their performance should give adequate attention to practices that enhance their internal integrative capabilities so as to serve as springboard for effective external integration with other supply chain members.

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