Supply Chain Management System of the Real Estate Industry (REI): A Study from Bangladesh Perspectives

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Like many other countries of the world, growing population and migration from rural to urban areas have also created enormous challenges for habitation in Bangladesh. All these necessitated the emergence of the Real Estate Industry (REI) with opportunities and by translating these challenges into opportunities through its supply chain stakeholders. With this end in view, the current study aims to investigate the supply chain management system of the REI in Bangladesh. From the review of literature, the supply of land, building material, construction material, outsourcing, labor, finance, logistic support, design, safety & security and utility services have been found as essentials in maintaining an effective supply chain which later on have been adopted through a primary survey on the real estate industry of the country and are found significant.

Keywords: Supply Chain Management (SCM), Real Estate Industry (REI)

Field of Study: Supply Chain Management

1. Introduction

The world, in this new millennium, is getting highly populated due to immigration in the developed countries while migrants from rural to urban areas and the unchecked birth rate in this part of developing nations. The factors such as globalization, labor mobilization, increased flow of cross boarder business, cultural diversity, etc., have substantially contributed behind this very trend of overpopulation. The vacant, agricultural and forest lands are gradually being occupied. In this trend, being one of the densely populated countries of the world, Bangladesh is in a challenging position in ensuring healthy habitation for all. The migration from rural to urban and city areas for occupational engagement is an additional pressure over the current challenge of population. In Bangladesh, the rate of urbanization is very high, aggravated by the high population growth rate and rapid rural-urban migration. The trend of urban growth in this country is about 3.25% per annum (Islam, 2012). So, providing housing facilities to these people will be a great challenge in the upcoming days if an effective supply chin cannot be ensured for the REI of the country. The current study focuses on the SCM system of the Real Estate Industry in Bangladesh. This is because the current study acted as the motivation to examine whether SCM system of the Real Estate Industry (REI) can effectively manage the housing requirement of the population of Bangladesh or not.

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Realizing the important role of SCM in the REI, secondary data have been collected. The current paper is unique because this paper not only focuses on the important factors of REI but also examines their role in mitigating the habitation challenges of the country. However, the current study is not free from limitations. For example, the major limitation of the present study is that the secondary data in the literature review section did not solely focus on the role of SCM of the REI in Bangladesh. Again some studies only focused on technical aspects of building construction, design and materials related issues other than the complete subject matter of the current study. Moreover, the findings of the earlier research mostly exhibit the SCM scenario of the other countries rather than Bangladesh. Relatively few studies have focused on this sector of Bangladesh. So, it is yet to get a concrete idea about the true situation of SCM factors of the REI in Bangladesh. Again some studies focused only on the few aspects of the subject matter of the current study.

It is because some of the previous studies adopted various qualitative frameworks or models while others focused on individual variables relating to the SCM system of the REI. However, none of them completely focused on this very aspect of the subject matter in effectively managing the housing requirement of the population of Bangladesh. So, it is clearly evident that there is a research gap and to mitigate this gap a rigorous research is yet to be attempted. Since the previous researches have not drawn the actual scenario of the SCM in effectively managing the housing requirement of the population of Bangladesh, more researches are required in this field and in this respect the findings of this study are different than those of previous researches. To fill up the knowledge gap left out by the previous researches, the present study investigates the research question: "Is the SCM system of the Real Estate Industry (REI) effective in managing the housing requirement of the population of Bangladesh?". Here, with relation to the appropriate answer to the set research question, the current paper is found as unique and different from the previous studies because by using the correlation and mean analysis on the individual variables, the current study identified positive relation between SCM and management of the housing requirement of the population of Bangladesh. The significance of the identified variables was verified and proved through various statistical tests including reliability, validity, correlation and mean analysis.

From the light of the above research question, the principal objective of this study is to examine whether SCM system of the Real Estate Industry (REI) is effective in managing the housing requirement of the population of Bangladesh or not so that the respective Real estate companies can take appropriate measures to further improve their quality.

This paper is organized with the various sections. Section 1 deals with introduction, Section 2 focuses on the background of the study, Section 3 contains the theoretical framework; Section 4 portrays the literature review, Section 5 portrays an conceptual model, Section 6 goes with the methodology of the study, Section 7 exhibits the analysis and findings, and Section 8 draws a constructive conclusion including uniqueness of the study, new findings, significance and implications and limitations.

2. Background of Real Estate Industry in Bangladesh

The real estate industry is the fastest growing sector of the country's economy with huge prospect in near future. The two main reasons which acted as the

driving forces behind the phenomenal growth of Real Estate Industry in Bangladesh are particularly population growth and migration from rural to urban areas. Urban population in Bangladesh is growing more rapidly than the population as a whole. In 1970, the urban population was only 7.6% whereas in 2010 it was 27.1%. In 2030, it is projected to reach 39.3% (World Population Prospects: The 2008 Revision, UN Population Division). That means that in near future (by 2040), half of the total population will live in cities. Providing housing facilities to these people will be a great challenge. It can also be noted that with the increasing trends of population, people are directed to cities. In 1974, the number of migrants was 2.43 million which accounted for 3.44 percent of the total population of Bangladesh. Latest Sample Vital Registration System (SVRS) 2008 of Bangladesh Bureau of Statistics reports that currently in-migration rate in Bangladesh is 30.62 per 1000 population where urban and rural in-migrants are 51.69 and 16.64 respectively. Higher migration occurred in urban areas than in rural areas. All these together have made housing as an acute problem resulting into the growth and development of REI in Bangladesh. In this regard, to ensure safe and quality housing against the value for money criteria, the Real Estate and Housing Association of Bangladesh (REHAB) was formed with only 11 members on 12 December, 1991. The objective of REHAB was to promote the Real Estate development in the private sector in Bangladesh. Currently, REHAB has 1189 formally enlisted developing companies (www.rehab-bd.org/member_list.php). With such gradually increased number of companies, various problems and difficulties concerning the housing sector also cropped up requiring proper attention .To solve these problems and protect the interests of all developers, it was necessary to form an association for the unhindered evolution of the Real Estate Sector. This institution plays very important role by protecting the customers of apartments from the fraudulent activities of the unregistered flat businessmen and giving safeguard to its listed real estate developing companies against any arbitrary decision by the government officials. With inauguration of REHAB Vision Fair 2010 by Sheikh Hasina, Honorable Prime Minister of Bangladesh, Government attachment and encouragement to activities of REHAB had been proved. As Honorable prime Minister promised, it is expected that in the future days Government will take necessary measures for the growth of real estate sector. The real estate has been emerging as one of the growing industries of Bangladesh contributing handsomely to the GDP.

3. Theoretical Framework

A supply consists of all stages involved, directly or indirectly, in fulfilling a customer request (Chopra and Meindl, 2001). But to achieve this very purpose a supply chain needs to be well managed. Supply Chain Management is the "strategic and systematic coordination of the traditional business functions and the tactics across these business functions within a particular firm and across businesses within a supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (Mentzer et al., 2001). Gunasekaran and McGaughey (2003) extended the scope of SCM beyond material management, partnership, information technology to the Total Quality Management areas like management commitment, organizational structure, training and behavioral issues. Supply chain management drastically alters inventory investment across a range of industries, and helps to tackle economic fluctuations (Heng et al., 2005). Zailani and Rajagopal (2005)

presented a model of an integrated business process, which highlights the importance of communication between processes and between partners in the supply chain. Supply chain involves the cost to convey the information, produce components, store them, transport them, and transfer funds and so on. The total cost of supply chain tends to increase due to many parameters like huge capital cost required for running global businesses, mounting real estate costs and freight charges (Koh, 2006). However the perfect planning in SCM regarding material arrival, production schedule and distribution not only reduces the inventory and inventory cost but also reduces the wasted time and energy (Verma et al., 2006).

4. Literature Review

4.1 Land Supply

Raw land as a key feature of the real estate cycle is the focal point of construction and expansion of business and the most characteristic feature of a real estate boom is the speculation of large under-developed land and the sale of lots in subdivisions to small investors (Seraj, 2016). In his study Islam (2012) found that being an agriculture-based country Bangladesh suffers from a scarcity of land where the urbanization level of 28% is substantially lower than in developed countries. Seraj (2016) found that scarcity of land is the main constraints of real estate business and building construction, and the price of raw land becomes very uncompetitive. However, it is a trend in the real estate development industry of Bangladesh that there is often a contract between the land owner and developer company. The general terms and conditions often are that the developer company bears all expenditures of constructing the building with all modern facilities necessary for apartment handover readiness. While in exchange the land owner shares his/her land proportionately with the developer (e.g., 50-50, or, 40-60 sharing ratio). In most of the cases, the developer companies sell the apartments of their share through the own sales, marketing and business development teams. Again some real estate companies develop modern apartment projects with their own land instead of shared business with the land owners. The names of Finlay, Mishmak, Sanmar, Equity, Elite Properties, etc., are noteworthy in this case. One new characteristic feature in this industry is that some real estate companies now prefer land development to building construction. In this context, the case of Sanowara Group in Chittagong is remarkable.

4.2 Building Material and Products Supply

Building material is any material which is used for a construction purpose. Such material includes raw materials like mud and clay, wood, rock, ice, sand, foam, steel rods or reinforced bars, cement composites, concrete (i.e., composite of aggregate generally gravel and sand and a binder such as cement to eventually harden a stone-like material). The metal, glass, plastic, thatch, brush, etc., are also included into the categories of building materials. This kind of material includes both forms namely natural and man-made that together enables real estate apartment building project developers to provide the make-up of habitats and structures including homes (Wikipedia). While building products often refer to the ready-made particles/sections, made from various materials, which are used to construct the building architecture and supporting fixtures like windows, doors, cabinets, etc. The list of building products does not include the building materials

rather they are fitted in architectural hardware and decorative hardware parts of a building. It also can refer to items used to put such hardware together like glues, caulking, paint, and anything else bought for the purpose of constructing a building. Housing and Building Research Institute (HBRI) of the housing and public works ministry has been working on the production of environment-friendly building materials for the past three years. Hossain, M (2017) highlighted in his write up in the daily Prothom Alo that HBRI has recently invented a new type of brick made of a river mud composite and cement that is portable and cost effective. The institute said the newly invented bricks will bring down the cost to half of what bricks cost now. HBRI has also invented specialized floor, roof and wall materials. The authorities also said the specialized wall, which is made of jute fiber and cement is sturdy and less prone to erode. As a result, there is handsome availability of environment-friendly and earthquake-resistant materials for building multi-storey structures in Bangladesh. Experts say use of these environment-friendly materials will help reduce environmental pollution as well as cut construction costs. According to HBRI the kind of building materials invented by the institute will cost 30 per cent less than conventional ones". According to Habib, M (2015), the major building materials used for real estate construction are as i) structural materials: concrete, reinforcement bars, steel, bricks & mortar, ii) finishing materials: floor tiles or stone, cladding, paint, aluminum sections, glass, wooden doors & cabinets, etc., iii) utility service: electrical conduits & cables, circuit breakers, control switches, light fittings, pumps, plumbing, faucets, etc.

4.3 Construction Material Supply

The real estate industry with special reference to building construction sector includes plumbing, bath rooms and air conditioning; electrical works, provision of power and wiring; painting, coating and treatment of surfaces; landscaping and gardening; roofing and waterproofing; road works and paving; architecture and civil engineering; manufacturing of building materials (http://www.building-construction.co.za/). The people who possess specialized engineering, managerial and administrative skills and expertise ensure the success of a real estate project by getting the customer requirements, designing a building solution, developing a project plan, managing suppliers and subcontractors and supervising the execution of the projects. With the joint efforts of the people engaged at different phases of the execution of the project, the building and construction work gets done. This is mainly done in two phases: in the first place, there are designs from the architects and civil engineers and in the second phase, there are building materials and those materials must be processed to become structures and buildings including: preparation of site, installation of basic infrastructure, rough construction work, plumbing, electrical and accessories, painting and finishing. Chandler (2001) classified building materials into different categories depending on their fabrication and in the way that they can handled on site. The categories include a) bulk materials that are delivered in mass and are deposited in a container, b) bagged materials delivered in bags for ease of handling and controlled use c) palleted material that are placed in pallets for delivery, d) packaged material that are packaged together to prevent damage during transportation and deterioration when they are stored and e) loose materials that are partially fabricated and that should be handled individually. For the quality of reinforced concrete construction Habib, M (2015) advocated a) integrity, cleanliness, size grading of the crushed stone; b) size & cleanliness of sand; c) cleanliness of water;

d) Quality of cement; e) Mix design ratio of stone: sand: cement and, the water: cement ratio, f) method and duration of mixing all ingredients, g) appropriate mode of carrying/pumping pouring and setting wet concrete, h) material, surface quality, dimensional tolerance, and adequate support of shuttering, i) Curing throughout the period of strength gain, usually 28 days. Again for the quality of structural steel construction Habib, M (2015) advocated a) the strength and consistency of strength of structural steel; I-sections, L-angles, C-sections, which should be fabricated from hot rolled billets, b) efficiency and correctness of Joint design, often by welding, or bolting, c) welded joint strength depends on the welding material, type, and quality, which must be assured with consistent non-destructive testing, d) bolted joint strength depends on the configuration, bolt material, and amount of tightening, which can only be ensured by using calibrated torque wrenches, e) sequence of construction, which done improperly may induce residual stresses and f) buildings constructed of structural steel are more flexible, and therefore better for earthquake design. However, the integration of steel frames to brittle elements such as infill brick walls and glass facades require special details. Standards of Bangladesh National Building Code (BNBC), American Standard for Testing Materials (ASTM), etc., are generally followed by the real estate companies for the proper verification of construction progress. Before the commencement of the construction work an environment feasibility certificate also needs to be obtained from Bangladesh Environment Authority. In this field, Professors and resource persons of various Engineering Universities of Bangladesh (e.g., BUET, CUET, KUET, RUTE, etc.), play important role.

4.4 Outsourcing or Sub-Contracting of Building and Construction Materials

Some organizations take outsourcing as a style to gain profit, cost saving, greater productivity or to concentrate on core business, etc. (Lankford & Parsa, 2006). Consequences of choosing outsourcing irrationally as a procurement strategy can significantly impact the effective coordination management, that is; in complex projects uncertainty increases and forecasting tend to be not easy due to high interdependencies between activities as a result coordination and controlling of suppliers tend to be more complex (Hui *et al.*, 2008). There are some core service activities related to real estate building construction such as concrete mix preparation, plumbing, electrical wiring; fixation of grill, doors, windows, lift & hoist, furniture and tiles; electrical board, security management, etc. It may be mentioned here that some companies opt for ready-mix-concrete from the third parties. In Bangladesh, ready-mix-concrete supply is an emerging sector because some such companies have already been established as a part of backward integration by the mother companies. But later on such companies have started to act as the supplier of ready mix concrete for other companies also. For example, EPIC Ready Mix Concrete is such an establishment by the EPIC Properties Ltd. Ready mix concrete producing and distributing companies now act as very important supply chain members in the REI. In their research, Zailudin and Omar (2016) mentioned that the application of Supply Chain Management in the production of ready mix concrete is very vital to ensure the quality of the materials, product, relationship between suppliers and customer's satisfaction. By citing Martin Christopher (1992), Zailudin and Omar (2016) found that the scheduling of ready mix concrete production and delivery is essentially a problem of material logistics planning, which is a decision process for strategically managing the procurement, movement and storage of raw materials, finished product inventory and the related

information flows throughout the organization and its marketing channels in such a way that the current and future profitability is maximized by cost-effective fulfilment of orders. Zailudin and Omar (2016) referred the findings of Iris D. Tommelein and Annie En Yi Li, (1999) where it was mentioned that concrete has its own time to set and harden, due to this problem, the batching and delivery of the ready mix concrete is a classic example of Just-In-Time construction system.

4.5 Labor Supply

REI is very much labor-intensive. The industry requires skilled, semi-skilled and unskilled labor supply. For the white collar workers (e.g., engineering, administrative personnel, etc.), real estate companies follow both internal and external recruitment process while the blue collar workers (e.g., physical labor intensive worker) are often recruited and selected daily or project basis through sub-contracting. It may be mentioned here that to ensure safety and security of workers is often a big challenge for the companies of this newly growing industry. For the welfare, health, hygiene, wages, leave and other issues of workers; Bangladesh Labour Code 2006 is a strict binding on such companies. The people who supply both physical and mental labor in the REI are of the following occupations namely: bricklayers; clay, cement and stone workers; architects and civil engineers; plumbers, electricians, carpenters, marketing and sales people, etc. As a major part of the construction sector, most of the labor force engaged in the construction sector is basically engaged in the REI. The following table shows the labor force engagement to the construction sector from 1999 to 2010.

Table 1: Labor Force Engagement to the Construction Sector

	1999-00	2002-03	2005-06	2010 (p*)
Total Labour Force	40,700,000	46,300,000	49,500,000	57,100,000
Labour Force in Construction sector (unit)	1,147,740	1,569,570	1,564,200	2,512,400
Labour Force in Construction sector (%)	2.82	3.39	3.16	4.4

Source: Statistical Year Book of Bangladesh – 2010

4.6 Financial Supply

Financial service providers namely banks, credit rating companies, and collection agencies that deliver services like making loans, doing credit analysis, and collecting on past due invoices. House Building Financing Institutions in Government, Non-Government sectors and private sectors often act as the major providers of loan to both the real estate developers for building construction under project financing and apartment buyers under different schemes of house loans. Recent estimates indicate that over 70% of the houses are rented in Dhaka and there is an annual requirement of over 60,000 new homes. Financial intermediation in the housing sector is not found adequate because of high interest rates and limited sources of funds (Bhattacharya D., 2003). This is true both for the financing of the developers and the purchasers. To finance their activities, governments, government agencies, financial institutions, and non-financial business enterprises need to obtain funds from the financial markets. These groups can obtain funds in any of a number of places within this broad marketplace. Such as, they may offer

participation or ownership shares (equities) for sales in the equity market, they may procure these funds through direct loans or through the issue of debt securities in the bond market, or they may acquire funds through the issue of debt instruments in the money market (Barua, Suborna et al, 2010).

4.7 Logistic Support Providers

Logistics became a distinct asset class itself, in the early 1990s, in line with the evolution of operational logistics and supply chain management (BNP Paribas Real Estate 2010; Bhutta and Migliorelli 2015). Prologis Research (2012) positively described the use of logistics in the real estate sector. As a part of their logistic support to the operation management, real estate companies generally maintain their own pick up, small truck, van, concrete mixture machinery, vibrator, power/diesel generators, lift, tower/roof hoist, wooden, bamboo and steel shutter; roofing through traditional bamboo structure or modern pico beam, guarder, etc. Again the companies which do not want to block their capital into such fixed investment often hire such machinery and equipments on rent.

4.8 Architectural, Interior & Exterior Designers

As mentioned by Colander (2003), design quality problems appear due to differing perceptions between the client and the design team. According to Project Guidance (2009), design disciplines in the real estate sector differ by the nature of standards, skills, and operation within the facility, and include i) structural Engineering, ii) architecture, iii) interior design, iv) landscape architecture, v) plumbing engineering, vi) HVAC and Refrigerating Engineering, vii) Information Technologies Engineering, viii) Low voltage/Low current System Design. According to Shen et al. (2012), communication between all design participants extends throughout the entire design process. They stated that in a typical architectural design situation, the design participants are mainly architects, clients and consultants from various disciplines. The client-design communication is important and thorough during the preparation of the brief and the design solution.

According to Oyedele and Tham (2007), attending to user requirements is the second most important architect performance criteria after effective pre-design meetings. Architect performance criteria in building projects as ranked by clients based on the importance index, are as follows (Oyedele and Tham, 2007): 1. Effective Pre-design Project Meetings 2. Forethought and Consideration of User's Requirements 3. Coordination among Phases of Design 4. Identifying and Prioritizing the Project Objectives 5. Standardization of Elements. According to Merritt and Ricketts (2001), architects throughout the design process of a real estate project should abide by the principles of i) portraying a visually pleasing facility from both the inside and outside, ii) eliminating all safety and health hazards faced during normal use and providing a safe evacuation/refuge for occupants during emergencies, iii) constructing a building which provides shelter and control of the interior environment (air, temperature, humidity, light, and acoustics) as specified by the client, iv) assuring minimum impact on the environment, v) minimizing energy consumption during operation whilst allowing the facility to serve its purposes, vi) limiting the costs of construction, operation, maintenance, repair, and anticipated future alterations to what is initially set by the client.

From the internal survey reports on some of the real estate companies of Bangladesh are mostly dependent either on their own employed civil engineers and/or consulting firms for the architectural design of the buildings. Depending on luxurious or economy apartments, some such companies depend on the paint, wood and aluminum products suppliers. The companies like Berger Paints, Asian Paints, Elite Paints, Thai Aluminum, etc., are the big players in this sector which act as very important stakeholders in both building interior and exterior design of such developers.

4.9 Safety and Security Service Providers

Management System of Building Safety (MSBS) may include the following nine aspects: regulation for industry management, laws for building management, function of property management departments, technical specifications for general investigation of buildings, technical standards for design and construction as well as maintenance of buildings, building information system on the internet/intranet, emergency measures, popular education on building safety, and expert decision making system for building management (Iveta P. et al. 2017). From land acquisition and building construction to handover and post-handover periods of ready-made apartments, the real estate developing companies need to ensure security and safety of the premises, construction site, building materials and products. For this purpose, retired defense and police professionals are the preferred source to most companies. However, in the last decade some security service providing companies have also been emerged in this industry.

4.10 Utility Service Providers

No real estate company can ensure complete readiness of its apartment without the connection of water, gas, power/electricity, etc., in the building. Indeed, without such connections the apartment will not be suitable for habitation or living. Further, to back up the said non-renewable sources of energy, Government of Bangladesh has recently notified all the real estate developers that 30% of power energy must come from solar. In addition, LPG facilities will be provided instead of pipe based Titas and Bakhrabad gas supply. To ensure self-sufficiency a real estate company can set up its own sub-station subject to the approval of Bangladesh Power Development Board (BPDB) and other concerned authority or authorities.

From the findings of the reviewed literature it is seen that some of the previous studies only focused either on one or some aspects other than the complete subject matter of the current study. So, it is yet to get a concrete idea about the impact of SCM of the REI in effective management of the housing requirement of the population of Bangladesh. It is because the findings of the earlier research mostly exhibit the result of SCM impact on the REI of the other countries rather than Bangladesh. Despite the proven success of this in other countries, relatively few studies in Bangladesh have focused on this aspect. Again some studies focused only on the few aspects of the subject matter of the current study. Due to such drawbacks of the previous studies the current paper aims to find a suitable answer to the research question: "Is the SCM system of the Real Estate Industry (REI) effective in managing the housing requirement of the population of Bangladesh?". With this end in view, the following hypothesis has been set to exhibit the appropriate answer: Relocate them to Literature review section.

H_0: The SCM system of the Real Estate Industry (REI) is not effective in managing the housing requirement of the population of Bangladesh.

H_a: The SCM system of the Real Estate Industry (REI) is effective in managing the housing requirement of the population of Bangladesh.

Assuring attractive design, fittings, amenities and handover or delivery of the apartments in time is always a matter of prime necessity to meet the REI buyers. However, there may be any such factor(s) which may adversely or more proactively impact on the timely handover of the apartments to the respective customers. Hence, the current study aims to test whether SCM system of the Real Estate Industry (REI) is effective in managing the housing requirement of the population of Bangladesh or not so that the respective Real estate project marketers can take appropriate measures to further improve their SCM system.

5. Analytical Model of the Present Study

From the light of the extensive literature review the following **Figure 1** has been developed for the present study to exhibit the analytical (i.e., graphical) model of the SCM of the REI.

Figure 1: Supply Chain Management System of the Real Estate Industry

Land supply	
Building material and products supply	
Construction material supply	
Outsourcing or sub-contracting of building and construction materials	**Supply Chain Management of the Real Estate Industry**
Labor supply	
Financing	
Logistic support providers	
Architectural, Interior & Exterior Designers	
Safety and Security service providers	
Utility Service providers	

6. Methodology of the Study

The current study is the combination of both primary and secondary data collection and their analyses in which, the secondary data have been collected from the updated research papers and articles published in the reputed journals relevant to the subject matter of the study. While the primary data have been collected during the month of August 16, 2017 to September 5, 2017 from the sample size of 94 respondents who are the customers and employees of real estate companies using random sampling method through a structured and self-administered questionnaire based extensive survey comprising of open-ended and non-forced, balanced and odd numbered, non-comparative itemized questions using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The correlation analysis has been used to identify the relationship between supply chain and its factors from the perspective of the real estate industry of Bangladesh. From the literature review 10 factors have been chosen as independent variable (v1 to v10) which have impact on supply chain management as dependent variable (v11). The identified variables are exhibited in the **Table 2** from v1 to v11.

Table 2: Supply Chain Management System of the Real Estate Industry

Code	Items	Sources
v1	Land supply	Islam (2012), Seraj, 2016
v2	Building material and products supply	Habib, M (2015), Hossain, M (2017), Wikipedia
v3	Construction material supply	Chandler (2001), Habib, M (2015), http://www.building-construction.co.za/
v4	Outsourcing or sub-contracting of building and construction materials	Hui *et al.*, (2008), Lankford & Parsa (2006), Zailudin and Omar (2016)
v5	Labor supply	Statistical Year Book of Bangladesh – 2010
v6	Financing	Barua, Suborna et al, 2010, Bhattacharya D., 2003
v7	Logistic support providers	Bhutta and Migliorelli 2015, BNP Paribas Real Estate 2010; Prologis Research (2012)
v8	Architectural, Interior & Exterior Designers	Colander, C. (2003), Merritt, F. S. and Ricketts, J. T. eds. (2001), Oyedele, L. and Tham, K. W. (2007), Project Guidance (2009), Shen, W. et al. (2012)
v9	Safety and Security service providers	Iveta P. et al. (2017)
v10	Utility Service providers	Habib, M (2015), http://www.building-construction.co.za/
v11	SCM	Chopra and Meindl, 2001, Gunasekaran and McGaughey (2003), Heng et al., 2005, Koh, 2006, Mentzer et al., 2001, Verma et al., 2006, Zailani and Rajagopal (2005)

7. Analysis and Findings

Based on the survey data, the following section exhibits the analysis and findings of this study.

7.1 Reliability Analysis

In the **Table 3**, the Cronbach's Alpha value of all the 11 items together is .821 which is greater than 0.7, indicating an overall higher reliability factors. Thus, it can safely be concluded by looking at **Table 3** that the reliability of this study is substantial in every perspective because the sample size and the data collected are reliable and also the reliability is shown to be good using all the 11 items.

Table 3: Reliability Statistics

Cronbach's Alpha	No. of Items
.821	11

Source: Field Survey Data

7.2 Validity Analysis

Table 4 exhibits that the value of Kaiser-Meyer-Olkin (KMO) Measure is .784 which is 'good' suggesting the adequacy of the sample size for the factor analysis. From the results of the Bartlett's Test of Sphericity it is seen that the approximate chi-square statistics is 283.866 with 55 degrees of freedom, which is greater than the table value. This means that the null hypothesis that the population correlation matrix is an identity matrix is rejected by Bartlett's test of sphericity. So, the result of Bartlett's test of sphericity is significant suggesting that the population was not an identity matrix. Therefore, the Bartlett's Test of Sphericity is significant.

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.784
Bartlett's Test of Sphericity	Approx. Chi-Square	283.866
	df	55
	Sig.	.000

7.3 Correlation Analysis

Table 5: Correlations

		Land	Building material	Construction material	Outsourcing	Labor	Finance	Logistic support	Design	Safety & Security	Utility	SCM
Land	PC	1	.498	.449**	.408**	.215*	.256*	.363**	.297**	.500**	.315**	.321**
	Sig.		.000	.000	.000	.038	.013	.000	.004	.000	.002	.002
Building material	PC	.498**	1	.432**	.398**	.215*	.461**	.534**	.158	.231*	.270**	.266**
	Sig.	.000		.000	.000	.038	.077	.000	.129	.025	.009	.010
Construction material	PC	.449**	.432**	1	.334**	.330**	.406**	.452**	.194	.366**	.278**	.343**
	Sig.	.000	.000		.001	.001	.000	.000	.061	.000	.007	.001
Outsourcing	PC	.408**	.398**	.334**	1	.393**	.312**	.421**	.309**	.205*	.328**	.303**
	Sig.	.000	.000	.001		.000	.002	.000	.002	.048	.001	.003
Labor	PC	.215*	.215*	.330**	.393**	1	.342**	.285**	.201	.195	.235*	.281**
	Sig.	.038	.038	.001	.000		.001	.111	.052	.060	.023	.006
Finance	PC	.256*	.461**	.406**	.312**	.342**	1	.352**	.501**	.341**	.242*	.396**
	Sig.	.013	.077	.000	.002	.001		.001	.070	.001	.019	.000
Logistic support	PC	.363**	.534**	.452**	.421**	.285	.352**	1	.511**	.230*	.320**	.268
	Sig.	.000	.000	.000	.000	.111	.001		.069	.026	.002	.115
Design	PC	.297**	.158	.194	.309**	.201	.501**	.511**	1	.284**	.303**	.307**
	Sig.	.004	.129	.061	.002	.052	.070	.069		.006	.003	.003
Safety & Security	PC	.500**	.231*	.366**	.205*	.195	.341**	.230*	.284**	1	.258*	.344**
	Sig.	.000	.025	.000	.048	.060	.001	.026	.006		.012	.001
Utility	PC	.315**	.270**	.278**	.328**	.235*	.242*	.320**	.303**	.258*	1	.208*
	Sig.	.002	.009	.007	.001	.023	.019	.002	.003	.012		.044
SCM	PC	.321**	.266**	.343**	.303**	.281**	.396**	.268	.307**	.344**	.208*	1
	Sig.	.002	.010	.001	.003	.006	.000	.115	.003	.001	.044	

N = 94

**. Pearson Correlation (PC): Correlation is significant at the 0.01 level (2-tailed).

*. Pearson Correlation (PC): Correlation is significant at the 0.05 level (2-tailed).

In the present study, a correlation coefficient measured the strength of a linear between the supply chain management or, SCM (v11) and its 10 factors from v1 to v10. The correlation between them is positive and is significant at both 0.01 and 0.05 level (2-tailed). The correlations **Table 5** shows the correlation between 'supply chain management or, SCM' (v11) and its influencing factors including v1: support and supply of land, v2: building material, v3: construction material, v4: outsourcing, v5: labor, v6: finance, v7: logistic support, v8: design, v9: security & safety and v10: utility services is/are .498, .449, .408, .215, .256, .363, .297, .500, .315, and .321 respectively. Therefore, the study exhibits that there is positive correlation between 'supply chain management or, SCM' (v11) of REI in Bangladesh and its influencing 10 factors. Thus, the result of correlation rejects the null hypothesis (H_0) that 'The SCM system of the Real Estate Industry (REI) is not effective in managing the housing requirement of the population of Bangladesh' and proves or accepts the alternative hypothesis (H_a) that 'The SCM system of the Real Estate Industry (REI) is not effective in managing the housing requirement of the population of Bangladesh'. So, there is a relationship as expected.

7.4 Mean Scores of Factors that Affect SCM of REI:

It can be concluded from the Table data that the mean values among the respondents were higher (means ranging from 3.4468 to 3.9574). It can be stated from the **Table: 6** data that all of the items exceeded midpoint 3 suggesting that the sample had a tendency to agree that sufficient items have given adequate perception among the

respondents. This suggests that respondents really have higher perceptions in terms of SCM of REI as positive outcome.

Table 6: Mean Scores of Factors that Affect SCM of REI

Code	Items	Mean
v1	Land	3.8723
v2	Building material	3.6383
v3	Construction material	3.5106
v4	Outsourcing	3.4894
v5	Labor	3.5745
v6	Finance	3.4468
v7	Logistic support	3.5106
v8	Design	3.9574
v9	Safety & Security	3.8298
v10	Utility	3.9149
v11	SCM	4.3298

So, each of the positive correlation values in **Table 5** and higher mean values in **Table 6** exceeding the midpoint 3 out of Liker scale 5 reject the null hypothesis (H_0) that 'The SCM system of the Real Estate Industry (REI) is not effective in managing the housing requirement of the population of Bangladesh' and prove or accept the alternative hypothesis (H_a) that 'The SCM system of the Real Estate Industry (REI) is effective in managing the housing requirement of the population of Bangladesh'.

8. Conclusion

From the light of the above study it is evident that there is high potential for this growing industry of Bangladesh. However, the balanced growth and development of the REI of Bangladesh will be hindered unless an integrated system of supply chain management is maintained. Hence, the concerned stakeholders in the supply chain of REI must have to be integrated.

The present paper is unique and different from the previous studies because of a number of reasons. First of all, the findings of the study exhibit the contribution of the various stakeholders behind the accelerated growth of the REI in Bangladesh. Such stakeholders include apartment construction and land developing companies, service providers like architectural firm, interior designers, security company, banks, finance companies, building material and logistic support providers, utilities like power and gas suppliers, home appliances, outsourcing and branding service, laborers and above all academia that supply graduates as human resources. Secondly, since most of the past papers could not draw a conclusive scenario of SCM of REI, the inclusion of multifarious variables from different research findings verified the current study through correlation and descriptive statistical analysis. The results of this study indicate positive correlation between SCM and ten (10) aspects of supply chain management system of the REI which exhibit effective management of the housing requirement of the population of Bangladesh through timely handover of the apartments to the respective customers. These aspects including land supply, building material and products supply, construction material supply, outsourcing or sub-contracting of building and construction materials, labor supply, financing, logistic support providers, architectural, interior & exterior designers, safety and security service providers and utility service providers were not discussed in such integrated form in the earlier studies. From this perspective also, the present paper is unique. So, the present study revealed that there is necessity to include the identified

ten aspects of supply chain management system in an integrated manner so that quality housing requirement of the population of Bangladesh can be ensured.

The present study has been found very much significant from the results of higher reliability and validity scores. The paper is also found positively correlated for its compliance with the correlation test criterion. In practice if SCM of REI can effectively mitigate the housing challenges of the country, the growth of the industry will be accelerated in one hand and satisfaction of customers will be maximized on the other hand. The findings of the correlation analysis and mean test evidenced that effective supply chain can positively meet the housing requirement of the population of Bangladesh. These values reject the null hypothesis (H_0) that 'The SCM system of the Real Estate Industry (REI) is not effective in managing the housing requirement of the population of Bangladesh' and prove or accept the alternative hypothesis (H_a) that 'The SCM system of the Real Estate Industry (REI) is effective in managing the housing requirement of the population of Bangladesh'.

But this paper is also not free from limitations as the current study endeavors to few aspects of the overall industry alone. Even though this, it is also expected that the current paper may contribute in the research and academic development of SCM of REI of Bangladesh through a systematic process of extensive literature review followed by the primary survey findings and analysis together with conclusive implications. Thus, the paper will enable the industry with necessary course of actions and new business models which will enable the academia in developing its theory based on proven practice.

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