

## Supply Chain Management on Project Management Performance: Special Reference to Construction Industry of Sri Lanka

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### **Abstract:**

Due to the significance imposed by the concept of supply chain management, the influence of supply chain management has been the focus of many empirical research studies done in order to analyze the overall performance of organizational projects in various contexts such as strategic competence, competitive advantage, sustainable business model, revenue generation and effective utilization of supply chain resources. Within the broad concept of SCM, TQM, supply base management and corporate policies that are end customer driven have been the mostly researched aspects. However, although these past researches have analyzed these concepts, the direct influence imposed by SCM on project success or project performance has not been critically evaluated and researched upon. Therefore, this concept paper aims to evaluate the influence of supply chain management on project management performance in the construction industry of Sri Lanka.

### **Keywords**

Supply chain management, project management, performance, effectiveness, efficiency, construction industry, project performance, supply chain integration, lean management

### **Abbreviations**

1. SCM - Supply Chain Management
2. PMP - Project Management Performance
3. SCMP - Supply Chain Management Practices
4. FP – Firm Performance
5. SCP – Supply Chain Performance
6. CDA – Construction Development Authority
7. DIFOTIS –Delivery In Full, On Time, In Specification
8. FSP - Firm's Supply Performance
9. TQMP - Total Quality Management Practices
10. SCR – Supply Chain Risk
11. HPM - High Performance Manufacturing
12. SCI – Supply Chain Integration

13. SCDR - Supply Chain Delivery Risk

14. SEM - Structural Equation Model

15. IT – Information Technology

16. TQM – Total Quality Management.

## **1. Introduction**

### **1.1 Background of the Study**

There have been many research and empirical studies to analyze the influence of supply chain management and its related contextual approaches on overall project management performance within the manufacturing industry, retail industry and construction industry sector in a global context, mainly pertaining to the fact that it has been evident through past empirical reviews that effective supply chain management plays a key role in delivering and contributing toward the overall performance of projects management matrices (Goslin, Naim, Towill, Abouarghoub and Moone, 2015). Furthermore it has been evident through past research that effective supply chain management practices (SCMPs) such as firm performance (FP) supply chain performance (SCP) collaboratively lead to the overall effectiveness and efficiency of project management within manufacturing and construction industries, altogether leading to the increased project performance in the Indian context. Based on this research where a theoretical model had been developed to investigate the influence of supply chain management practices on firm performance and supply chain performance, which has been evaluated through a multiple regression model it has been revealed that supply chain management practices positively influence both firm performance and supply chain performance. Furthermore, it has also been found out that effective customer relationships management and effective management of supplier relationships and networks are the two main factors of supply chain management practices that influence FP and SCP (Gandhi, Shaikh and Sheorey, 2017). However, based on the past research findings it has also been identified that despite the importance of understanding the influence of supply

chain management on project management performance, this study area has rather been overlooked by many researches, leading toward a gap of existence of longitudinal research insights. These findings have been revealed after the comprehensive analysis of international construction archival records from a range of 1990 – 2013 years (Goslin, Naim, Towill, Abouarghoub and Moone, 2015). This is further heightened within the Sri Lankan construction industry context as there are no sufficient comprehensive studies to be found within this context. Therefore, the purpose of this concept paper is to investigate the Influence of Supply Chain Management on Project Management Performance with Special Reference to Construction Industry of Sri Lanka.

## 1.2 Industry Overview

The construction industry of Sri Lanka has been identified as one of the main contributors toward the nations' GDP as well as the rapid growth and development of the economy of Sri Lanka over the past 6 years. Beginning from the end of the civil war of Sri Lanka in the year 2009, the construction sector of Sri Lanka grew more than four folds as compared to previous years and has been of high standards including housing schemes, office spaces and apartments. As per NDB securities report published in 2014, it was identified that the construction sector of Sri Lanka had grown by 20% by the end of 2014. However, by the end of 2016, it was recorded a staggering 62% increase in the construction industry of Sri Lanka. This is mainly due to the tourism boom and the reach of a staggering 2 million tourist arrivals to Sri Lanka by the end of 2016. With this, many international hotel chains and apartments brands have begun its construction in the capital as well as other areas of Sri Lanka, further contributing toward the growth of the construction industry of Sri Lanka (Chamber of Construction Industry, Sri Lanka, 2017). In 2014 the construction industry of Sri Lanka accounted to a dramatic increase of 9.6% of the GDP compared to previous years which increased even further to reach a dramatic level of 12.56% by the end of 2016, which is a large-scale achievement. This also recorded a significantly high proportion of the national economy when compare dot most other Asian countries (Weerasooriya, 2018). Furthermore, when actual figures are being considered, the contribution of the construction industry of Sri Lanka toward the national GDP has risen vigorously. The Q4 of 2016 has recorded a dramatic 200,970 million Rupees worth contribution of the construction industry toward the GDP of Sri Lanka. This was a 3 fold increase when compared to

all previous 6 years starting from 2010. Moreover, the proportional contribution of the construction industry of Sri Lanka has recorded a year on year increase with just 6.6% in 2009 and 9.6% in 2014 which further increased to 12.5% in 2016. This has been maintained in the first quarter of 2017 which displays a positive trend showing that a boom in the construction industry of Sri Lanka (Tradingeconomics.com, 2018). Despite these increasing positive trends, there have been fluctuations as well, especially in the year 2015 when the government of Sri Lanka was shifted. There were many holds implied to construction sites such as the Lotus Tower, port city of Colombo and the highway constructions with this shift. However, these have initiated and are in the full swing currently, adding on more toward the construction site overall performance of Sri Lanka (Weerasooriya, 2018). Despite these fluctuations, in a nut shell the construction industry of Sri Lanka has accelerated its performance since the year 2011 with the development of many new airports, ports, harbors, highways and expressways, apartments and hotels and new projects of international investment coming up (Tradingeconomics.com, 2018). It is believed that the new and proposed construction projects will further boom the overall performance of the construction industry with special projects such as the Lotus Tower, Shangri La shopping complex and office spaces, Colombo port city, Cinnamon Life constructions, luxury hotel complexes such as Sheraton and Hyatt, Twin Peaks, Colombo city centre and the many high-end real estate sites that are currently under construction and are proposed to be built. This is further to be enhanced with the infrastructure projects such as the Construction of section 2 of Central Expressway and the Rehabilitation Improvements to road between Peradeniya and Badulla (Munasinghe, 2017)

Amidst all of these construction projects that are completed, on-going and proposed, majority of the projects are generated by the government, specifically in the infrastructure constructions sector within the construction industry. The Sri Lankan government accounted for over 95% of the construction projects in Sri Lanka by the end of 2012. However, this has now changed due o the many private sector construction companies who have entered those segment and is estimated to grow further. However, until such time, the government will remain as the key player in the construction industry. Based on a market research it has been found that within the year 2014 there have been constructions worth of LKR 397.77 Billion in Sri Lanka that included road development, railway development and real estate. The construction industry has also made direct employment

opportunity for over 200 people just within the year 2015 and overall for the past 6 years over 680,000 people either directly or indirectly depend on the construction industry of Sri Lanka. All of these are facilitated by over 2500 local construction firms that are registered under legal terms of Sri Lanka and the Construction Industry Development Authority (CIDA) (Sri Lanka Export Development Board, 2018). Although mainly focused on infrastructure development, the construction industry of Sri Lanka also focuses on many other aspects and services such as green construction, mini hydro power plant related constructions, road and railway development, housing and real estate projects, expressways and highway development, hotel development and other engineering based construction projects (Sri Lanka Export Development Board, 2018)

### 1.3 Purpose of Study

This study has been undertaken with the purpose of examining the Influence of Supply Chain Management on Project Management Performance by giving special Reference to Construction Industry of Sri Lanka. The main reason for the researcher to select this particular subject area is that effective management of supply chain of firms is becoming an increasingly popular topic for research studies, both academic and corporate as well as its significance toward business success has grown over the years in international contexts. Furthermore, in a more particular view point, many research studies have identified that over 60% of the overall project success of construction projects depend on effective and timely management of its supply chain, determining the lead times, determining the raw material procurement processes, determining the on time delivery and long-term relationship management with suppliers, in bound logistics and outbound logistics and overall DIFOTIS concept – meaning delivery in full, on time, in specification. Therefore, with the increasing rates of construction projects and the bloom of the construction industry of Sri Lanka, the influence of supply chain management on the project management performance will gradually increase in its significance. As much research has not been done in this context in the Sri Lankan framework and as the research insights gathered from past research done in international contexts is not sufficient to generalize the same insights for the Sri Lankan context due to differing external macro environmental factors such as political, economical, social, technological, environmental and legal, this research study has been undertaken to bridge the existing gap, and to understand the influence of Supply Chain Management on Project Management Performance

by giving special Reference to Construction Industry of Sri Lanka with critical review and analysis of empirical reviews, theoretical reviews and similar case studies undertaken and published in international contextual settings.

### 1.4 Methodology

When methodology of concept paper development is being considered, there are three areas of concern. Those are the research approach, research design and the data collection procedures. The research approach means the methodical approach followed to complete the concept paper which has two main areas namely deductive approach and inductive approach. Deductive approach is where currently existing information is being analyzed through past research papers, statistical data and other means of secondary data and understanding the background of the subject area so as to identify an area which lacks current study and further investigate on that area to get clarification whereas an inductive approach is where a completely new area of study is identified and experimented to generalize the results and convert it into theoretical model. The deductive approach has been followed for this concept paper development. The research design followed has been the “content analysis” approach which refers to the collection, evaluation and insight generation based on secondary data sources that have been undertaken in similar context. Therefore, past research papers belonging to the similar contexts and similar subject areas have been chosen for this study. The criteria considered by the researcher when selecting the papers have been that those belong to contemporary contexts as much as possible so that the arguments and insights are valid and applicable to the current context as well, the paper has been conducted in academically acceptable research environment and with standard research procedures, belonging to the research areas of project management, supply chain management, supply chain performance, project success, project performance and the construction business. The literature sources utilized and referred for this concept paper development are Bayraktar, Erkan ; Demirbag, Mehmet ; Koh, S.C. Lenny ; Tatoglu, Ekrem ; Zaim, Halil (2009), Chaharsooghi, S. Kamal ; Heydari, Jafar (2010), Christoph, Flöthmann (2018), Demirkesen, Sevilay ; Ozorhon, Beliz (2017), Ghaith, Werikat (2015), Gosling, Jonathan; Naim, Mohamed; Towill, Denis; Abouarghoub, Wessam; Moone, Brian; (2015), Hatmoko, Jati Utomo Dwi ; Scott, Stephen (2010), Meng, Xianhai (2011), Munasinghe, I. (2017), Ruiz, Rocío ; López, Cristina ; Real, Juan C. (2018), Vanichchinchai, Assadej ; Igel, Barbara (2011), Weerasooriya, L. (2018) and Zhao, Li ; Huo, Baofeng ; Sun, Linyan ;

Zhao, Xiande (2013). When the data collection procedures are being considered, there are two main sources of collection of data. Those are primary data collection and secondary data collection. Primary data collection is first-hand data that is collected directly by the researcher with personal interactions with the respondents via methods such as observation, surveys, and experiments and interviews whereas secondary data collection refers to the act of referring already collected data that can be accessed via credible sources such as corporate websites, past researches carried out, past concept papers, industrial statistical reports, corporate publications and annual reports. For this concept paper, secondary data collection procedures have been deployed. Although the research area of this concept paper refers to the influence of SCM on PMP, the researcher has narrowed down the focus toward the construction industry of Sri Lanka with the aim of focusing the scope on a particular aspect of SCM and PMP for better opportunities of evaluations and future research.

## 2.0 Literature Review

### 2.1 Definitions of Terms

- Supply chain – the step-by-step sequential process involved in a manufacturing organization that includes tasks from the point of order receiving to the point of order delivery (Kate, 2017)
- Project management – the methodical process of initiating a specified tasks with defined timelines, resource allocations and budgets, designing the tasks, executing, monitoring controlling and closing the task by successfully achieving it within set deadline and budgets (PMI, 2018)
- Supply chain management – the effective management of the step-by-step sequential process involved in a manufacturing organization that includes tasks from the point of order receiving to the point of order delivery by ensuring DIFOTIS - delivery in full on time in specification (Kate, 2017)
- Project management performance – timely achievement of assigned tasks and objectives of project management (PMI, 2018)
- Construction industry – the development and real estate building sector of the Sri Lankan economy which focuses on road, highway and expressway development projects, housing scheme developments, apartment and real estate projects, tourism related construction relating to hotels, villa and boutiques and other constructions such as schools, hospitals, offices

(Investopedia, 2018). Sri Lanka's construction industry is a key contributor toward GDP focusing on all these aspects of constructions as defined above (Chamber of Construction Industry, Sri Lanka, 2017).

### 2.2 Empirical & Case Reviews

It has been evident that the influence of supply chain management has been the focus of many empirical research studies done in order to analyze the overall performance of organizational projects in various contexts such as strategic competence, competitive advantage, sustainable business model, revenue generation and effective utilization of supply chain resources. Within the broad concept of SCM, TQM, supply base management and corporate policies that are end customer driven have been the mostly researched aspects. However, although these past researches have analyzed these concepts, the direct influence imposed by SCM on project success or project performance has not been critically evaluated and researched upon. Therefore, one study has been undertaken in the UK context to understand the influence of TQM, supply base management and corporate policies that are end customer driven on the project success of organizations defined by strategic competence, competitive advantage, sustainable business model, revenue generation and effective utilization of supply chain resources. Based on an analysis done through regression analysis, it has been evident that all three factors positively and directly influence overall project performance referred to as PMP in this study (Tan, Kannan, Handfield and Ghosh, 1999)

As per a similar study previously done in the context of supply chain management, it has been found that lead time of both inbound and outbound logistics acts as the base vital factor of determining the overall concept of supply chain management and hence it determines the extent to which overall performance of a particular project is being affected. Inbound lead time is defined as the time taken from the point of an organization placing an order with a supplier and the final delivery of the ordered raw material to be full delivered to the organization and outbound lead time is defined as the time taken from the point of a customer placing an order with an organization and the final delivery of the ordered raw material to be full delivered to the customer. Therefore, inbound and outbound logistics directly influences the project management performance of a project. Due to this vitality of lead time in supply chain management, there are many key concern areas that are currently being studied to ensure lead time is managed effectively so that overall project management performance is not affected negatively. Once such

concept is lead time uncertainty which is referred to as the uncertainty of accurately determining the inbound and outbound lead times due to external factors such as political, economical, social, technological, environmental and legal. Therefore, this leads to affect the procurement policies, levels of inventory of raw material and availability levels of products that in turn affect the overall PMP negatively. Furthermore, there are two strategic concerns that are associated with lead time uncertainties. Those are adapter strategies and shaper strategies. These can be applied effectively to manage LT uncertainties so that PMP is not negatively affected. Through this study it has been identified that LT variance strongly influences the SCM and eventually PMP either negatively or positively based on the manner in which it is managed. This is also combined with SCM concepts such as holding inventory, number of stock-outs, bull-whip effect and holding inventory that collaboratively affect SCM. Therefore, the findings of this research implies how an effective LT management strategy can be implemented to suit different industrial environments (Chaharsooghi and Heydari, 2010)

As per previous studies done in similar context, total quality management practices (TQMP) is identified as another key vital factor that is contained within the broader concept of SCM that ultimately affects the PMP, referred to as Firm's Supply Performance (FSP) in this study. This has been done specifically in the automotive industry of Thailand. However it has been then generalized to many other industries including the construction industry as well. Based on this study it has been revealed that TQMP is an important factor in composing a sound and effective SCM strategy and it not only positively influence SCM but also indirectly collaborated with SCM to influence the overall PMP, referred to as FSP (Vanichinchai and Igel, 2011)

Based on another research study conducted in a similar contextual setting it has been revealed that SCM is defined by two main vitality factors as supply chain risk (SCR) and supply chain integration (SCI) that collaboratively entwined to affect the overall performance of the organization in a globally generalized context. This was carried out based on High Performance Manufacturing (HPM) projects that were being conducted in 317 different manufacturing plants in 10 countries world-wide. Although it was specifically undertaken for three industries, namely machinery, electronics and transportation, the results and interpretations have been generalized to suit different project based contexts and the structural equation model (SEM) has been deployed for the analysis. It has been evident through this study that the main component

of SCR is Supply Chain Delivery Risk (SCDR) and it highly affects the SCI and ultimately affects SCM PMP. It also revealed that the relationship between SCDR with overall SCM and PMP is negative and relationship between SCI with SCM and PMP is positive. Furthermore, this study has revealed that there is a contingent relationship between SCI and PMP and also that there are various types of SCI that could different influence on PMP. Out of the different types this study reveals that the highest significant factors are the supplier integration, internal employee integration and customer integration that directly influence the PMP. How these affect PMP is that these are directly associated with concepts such as customer satisfaction, effective relationships building with suppliers, reduced lead times, satisfied employees, increased efficiency and effectiveness of employees that ultimately lead to increased PMP (Zhao, Huo, Sun and Zhao, 2013)

Furthermore, another study in the same context has focused more on the importance of technological intervention and IT related innovations in driving effective SCM that ultimately lead to project success. When referring to project success it has been defined as meeting all set project targets within pre-determined budgets, timelines and other resource allocations. This study has been conducted among 203 manufacturing based small and medium scale organizations in Turkey and the findings have been generalized thereon. Through the study it has been revealed that technological intervention and IT related innovations act as mediating factors on the relationship between SCM and project success. Therefore, technological intervention and IT related innovations is referred to as a vital factor in studying the concept of influence of SCM and PMP in this study. The final findings of the study have revealed that both technological intervention and IT related innovations directly and positively mediate how SCM is being carried out which ultimately positively influence the overall PMP (Bayraktar, Demirbag, Koh, Tatoglu and Zaim, 2009)

Moreover, based on another study conducted in similar contexts it has been identified that SCI is an attribute within the broader concept of SCM and higher the level of effective SCI, the more consistency would be observed in PMP therefore exerting a direct positive influence on PMP. Therefore it has been identified that effective SCI should be implemented throughout the supply chain of an organization irrespective of the industry in which it operates so as to streamline all processes between all interdependent stakeholders, specifically the suppliers, employees and customers and also from the point of customer need recognition right through procurement to inbound logistics to manufacturing to packaging to outbound logistics

(Goslin, Naim, Towill, Abouarghoub and Moone, 2015).

Another study has been undertaken to strategically break down the concept of SCM into interdependent variable so that the influence of each of those variables can be studied separately on the organizational performance and success. Accordingly they have identified three key variables that construct SCM. Those are employee individual competence, resource based view of the organization and lead time management of inbound and outbound logistics. The analysis has been done based on SEM and bootstrapping mediation analysis method with data collected from a survey conducted among 273 managers from the field of construction in France. Furthermore, theoretical aspects of “Knowledge Management” and “Human Resource Management” have been applied to understand the individual employee competencies and other psychological aspects that are related with performance in SCM. It has been evident that all three variables of individual competence, resource based view of the organization and lead time management of inbound and outbound logistics directly and positively influence the overall SCM that lead to organizational performance and success. It has also been evident that training, learning and development provided by the organization enhance the individual employee competencies which are an investment toward organizational performance and success (Christoph, 2018)

Through another research study it has been identified that project performance of different construction projects is based on various dimensions of the concept of project management, thus establishing direct relationships between construction project success and project management that are key areas of this study. Integration management aspect which is a one of the many aspects of effective project management has been identified as a key determinant of project performance as it integrates suppliers, employees and company resource allocate within the construction project. Therefore, this study focuses on identifying key attributes of effective integration management and analyzing their influence on project performance. As such through the findings of this research it has been evident that the integration attributes such as project charter development, integration of knowledge integration of processes, staff integration, integration of changes and integration of supply chain act as key determinant of project success, thus verifying that supply chain management is one of the determinant factors of PMP (Demirkesen and Ozorhon, 2017)

Furthermore, it has been evident through a research study that the concept of lead management within the broader aspect of SCM is a key determinant factor of

overall performance of an organization. The purpose of this study was that sufficient literature was missing in order to analyze the effect of lead management on organizational success. Therefore, this paper has been focused on analyzing the different aspects and parameters of lead management and how each of these affects the overall organizational performance in terms of productivity. Interpretive Structural Modeling approach has been deployed for the analysis of this study through which it has been identified that there are three key parameters of lead management. Those are systematic processes, value creation and perfection and each of these three positively and directly influence the overall productivity level of organizations within the aerospace industry of USA and thereby it is evident that lead management directly and positively affects the organizational performance (Ruiz, Lopez and Real, 2018)

Furthermore, a study elaborates that the construction industry is defined by its key process of material flow, labor and work forces, skills, expertise, lead times, raw material, suppliers, inventory management, plant and equipment management and logistics each of which can be referred to as a separate project hence why project management is intensely bound to the construction industry. However, the reciprocal hold true as well as the effective management of supply chain activities generate project management success when integrate effectively as explained by this study. Therefore, this study has measured the influence of different SCM practices on the overall project performance. It has found out that sub-contractors play a major role in influencing the SCM practices and hence project success. Furthermore, effective lead time management and effective inventory management of SCM directly and positively influence project success in the construction industry according to this study (Hatmoko and Scott, 2010)

As per previous studied done, it has been evident that construction projects regularly undergo situations of decreased and poor performance when referred to areas such as project delays, lead time issues, outrunning the estimated and budgeted costs and overall quality issues. Therefore, the causes of decreased and poor performance of these construction projects have been analyzed. However, through analysis it has been evident that only a few studied have been carried out and undertaken in the context of understanding the influence of supply chain management best practices and overall project performance when the construction industry is being considered. Therefore, to fill this gap initially the study focused on understanding the influence of supply chain management best practices and overall project performance in the construction industry.

Based on that, effective SCM has been defined by attributes such as mutual trust, integration, lead time management, supplier relationship, effective communication, setting timely targets and effective logistics management. Through this study it has been revealed that all these areas of effective SCM directly affect the overall project performance of construction industry (Xianhai, 2011).

### 3.0 Limitations of the Study

One of the main limitations of this study is that it has only focused on secondary data which means data that has already been collected for previous research purposes and are available through sources such as past research papers, annual reports, corporate websites, statistical reports, web articles and newspaper articles. Therefore, the data could be outdated and data will not be directly related to the context of this study although could be applied. Therefore, this could reduce the accuracy of the discussion points that are being applied to the concept paper development. Limitation of time is another key challenge of this study as the limited time frame would inhibit extensive research practices such as surveys and interviews for data collection. The limitation of resources such as money and technology for the extensive research procedures such as data collection and data analysis through primary sources is another challenge faced. Furthermore, the unavailability of sufficient research stuffed in the local context pertaining to the construction industry of Sri Lanka is yet another challenge. The limitation of data collection methods is another challenge that limits the scope and accuracy of this study as it only focuses on secondary sources. More complex methods such as surveys, case studies, observation and interviews are not being used in this study.

### 4.0 Conclusion and Further Research

Based on the many different empirical reviews it has been evident that there are different attributes of supply chain management such as supply chain integration, supply chain risk, supply chain delay risk, lead management, lead time, supplier integration, employee integration, resource integration, procurement, delivery integration, manufacturing integration, inbound logistics and outbound logistics that collaboratively form a sound strategic approach toward effective supply chain management. All of these attributed have been studied in the identified past researches against the effect each has on overall project success or project management performance either in construction

industry or related industries such as manufacturing, transport and retail. Therefore, it has been identified that the overall concept for supply chain management has a positive and direct influence of project management performance. However, this study has been done with many limitations such as focusing only on secondary data sources, limited time, limited resources and unavailability of past researches done in similar study areas in the Sri Lankan contexts. Therefore, future research could focus on referring to primary data sources that would be more relevant and accurate for this study such as interviews, surveys and observations and using actual indicator and parameter of project performance such as profit generation, timely achievement of targets or sales growth (Gandhi, Shaikh and Sheorey, 2017).

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