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The Supply Chain Management Practices of the Ship Repair Industry in Colombo Dockyard: Literature Review

Anna Weerakoon Karunatilleke [1*]
1. University of Kelaniya, Sri Lanka

*e-mail : awkarunatilleke@gmail.com

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Abstract

Purpose – This study investigates the relationships between employee involvement, partnership management, and supply chain performance in Sri Lanka's ship repair industry, focusing on Colombo Dockyard Ltd (CDL).

Methodology – Using a literature review, the research describes supply chain processes, procurement practices, and competitive dynamics within the dockyard's operations. Data were collected through document analysis, literature review, and process mapping, supported by visual tools such as flowcharts and gap analysis frameworks.

Findings – The study identifies critical challenges such as dependence on imported marine materials, price fluctuations, and inefficient procurement timelines. A key structural barrier highlighted is the lack of local manufacturing capabilities, which impacts cost and responsiveness. Despite these constraints, the study reveals opportunities for improvement through strategic partnerships, localized sourcing, and integrated supply chain models.

Originality – By providing evidence-based insights, this research contributes to the development of sustainable, competitive strategies for medium-sized ship repair yards in South Asia and offers policy-level recommendations for sectoral development.

INTRODUCTION

Supply chain management plays a critical role in the ship repair industry by linking a network of interdependent companies (Håkansson & Persson, 2004; Harland, 1996) That adds value throughout the transformation of raw inputs into the final services demanded by end-users. According to the study Shipbuilding and Ship Repair Workers Around the Globe: Case Studies 1950–2010, seaborne trade serves as the backbone of the global economy, accounting for approximately 90% of international trade (Varela et al., 2017). For a vessel to undertake maritime voyages, it must meet standards of seaworthiness (Kontaxaki & Alexandropoulou, 2023; Zhang & Phillips, 2016)—meaning it has successfully passed essential safety checks and maintenance protocols in accordance with admiralty law. Pettigrew and Smith (2019) highlight that in legal proceedings concerning vessel conditions, inadequate construction and maintenance are frequently identified as the primary causes of property damage or loss

*Corresponding Author

of life. In such cases, ship owners and operators are typically held accountable for these failures in maintenance. The types of vessels are covered in Figure 1.

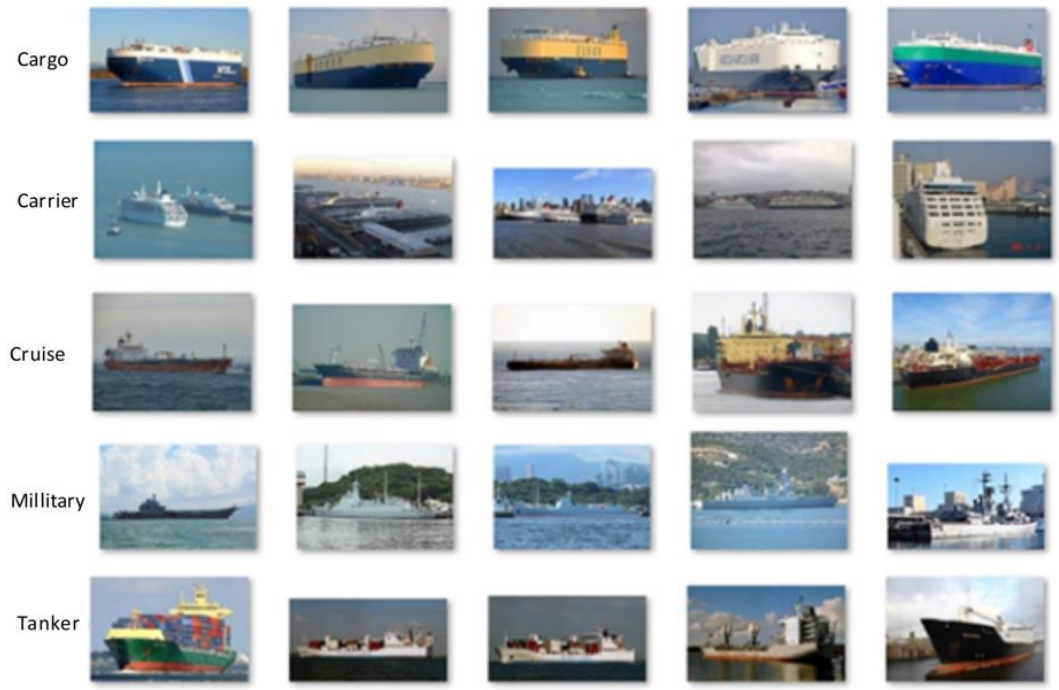

Figure 1. Types of Vessels
Source: Adapted by Ship Classification Based on Improved Convolutional Neural Network Architecture for Intelligent Transport Systems

According to the Ministry of Ports and Aviation website (2021), an average of 10 vessels are birthed every day in Colombo Port (J. Rathnayake et al., 2021). These vessels are owned mostly by foreign companies who through the CASA (Ceylon Association of Shipping Agents, 2021) would find local companies to maintain their vessels in case of any emergency repairs. The supply chain management is an important factor in these companies as in ship repair more than 65% of the total cost of production contribute by the materials used for repair, as none of the marine quality materials are not produced in Sri Lanka and are entirely dependent on the international market (CDL Website, 2022). This is able to make a significant impact on the top line as Quality materials deliver at the right time with the minimum cost is the requirement.

Major repairs such as dry docking are carried out at Colombo Dockyard. Current ship repair faculties provided by Colombo Dockyard Ltd (CDL) (Karunasena, 2000; R. Rathnayake et al., 2025) of which Onomichi Dockyard of Japan owns 51%, predominantly cater for repairs of large vessels up to 125000 DWT vessels, Dry Docks of capacities 8000 to 30,000 DWT have been converted into New Building Bays due to new orders secured by the Company. 125000 Ton Dry dock No 4 is not fully operational to the maximum capacity due to a lack of orders from Shipping Corporation of India, because of the fact that all the old tankers have been taken out of service. Vessels /Supertankers plying in the area patronise Dubai and Bahrain Dry Docks and Singaporean Yards. Hence, CDL uses 125000 DWT dock numbers 4 to 6 for repairs of smaller vessels that are docked at the same time, thus depriving small vessel owners of receiving the repaired vessels in due time of completion, as CDL has to wait for undocking of all vessels at the same time. In addition to above, very high overhead charges of CDL are comparatively high, sometimes more expensive than other yards in Singapore, Vietnam, and Thailand (CDL Website, 2022).

Figure 2. Repairs at Dock 4
Source: Image taken by Author

METHODOLOGY

Research Design

This study adopts a literature review to explore supply chain management practices in Sri Lanka's ship repair industry, with a specific focus on Colombo Dockyard Ltd (CDL). The qualitative design allows for an in-depth understanding of contextual processes, operational challenges, and the strategic alignment of supply chain functions within a complex industrial environment (Khan et al., 2012; Lin & Chu, 2024).

Data Collection

Data were collected through document analysis and literature review (Karppinen & Moe, 2019; Seuring & Gold, 2012). Company reports, procurement records, process charts, and policy documents from CDL were examined to gain insight into existing supply chain practices. In addition, secondary data were gathered from academic journals, industry publications, and official websites (e.g., CDL, Ministry of Ports and Aviation, CASA) to support comparative analysis and identify best practices in regional shipyards.

Analytical Framework

The collected data were analysed using a literature analytical approach (Onwuegbuzie et al., 2012; Samuelsen et al., 2019). Key focus areas included procurement processes, vendor management, material sourcing, and information flows. Thematic coding was used to categorise data into core components of supply chain management, including Product flow, Information flow, Finance flow, and Commercial flow. Special attention was given to the procurement process**,** which was mapped and evaluated to understand its role in facilitating or hindering supply chain efficiency.

Visual and Comparative Tools

To enhance clarity, process flow diagrams and visual models (e.g., Material Ordering Cards, Dock Operations Charts) were created. Furthermore, CDL's practices were benchmarked against regional competitors (e.g., Singapore, Vietnam, Thailand) to identify competitive gaps and opportunities for improvement.

Validation and Trustworthiness

To ensure credibility, multiple sources of data, and findings were cross-checked against industry benchmarks. Researcher reflexivity and transparency in data interpretation were maintained throughout the study.

LITERATURE REVIEW

The contemporary literature reveals that firms have a variety of reasons (drivers) to engage in partnerships with other firms (Forrest & Martin, 1992; Min & Zhou, 2002). In empirical research among manufacturers, Chin et al., (2004) identified five key reasons for implementing SCM partnerships: reducing operational costs, improving customer satisfaction, improving inventory and lead times, and remaining competitive, as in the Korean firms (Youn et al., 2013). Rajagopal et al., (1992) considered cost reduction, effective procurement, and inventory reduction as some important drivers for SMEs to

engage in a partnership. Lambert (2008) and Lambert et al., (1996) identified a comprehensive list of potential drivers, which are divided in four main categories: asset/cost efficiency, customer service, marketing advantage, and profit stability/growth. These drivers all indicate that firms' main motivation for engaging in supply chain partnerships is to improve firm performance (Glenn Richey Jr et al., 2009). Thus, the firm needs to identify those relationships that are beneficial to it and meet the expectations derived from the drivers. To fully understand the complex concept of collaboration between partners in the context of SCM, it is necessary to look at both partnerships between entire organisations (the organisational perspective) and partnerships around specific functions within these organisations (the functional perspective). Partnership is a central concept in SCM. It is a type of inter-organisational relationship that can range from transactional cost-based to vertical integration (Ellram & Cooper, 1990). The literature on SCM has mainly taken an organisational perspective on partnership (Maheshwari et al., 2006).

Evaluating the current knowledge in this area

The research studies were carried out by analysing the literature review (Nightingale, 2009). The current literature has primarily been written by scholars from countries with extensive business in the shipping sector, as shown in Figure 3, particularly coastal countries with good docking facilities for complete vessel repairs, including maintenance. In the Asian region, the most significant number of e-journals was published by scholars in Malaysia, Singapore, and Indonesia. The map shown in Figure 3 was created by analysing 111 literature articles on this topic and adding this information to a single Google map using the software ENDNOTE 20, and plotting the points of origin of the authors of the e-journals used for this literature review.

Figure 3. Geography of the articles
Source: Analysis created by the author using Google Maps

Table 1: Research Gaps in Literature

GAP	Description
Evidence Gap (Contradictory Evidence Gap)	Results from studies allow for conclusions in their own right, but are contradictory when examined from a more abstract point of view [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017]. The researcher identified an apparent evidence gap in the prior research concerning sustainability in maintenance engineering. In previous years, research has addressed several aspects of logistics and ship building [(Karatuğ et al., 2023; Zakaria, 2012)]. However, the prior research had not addressed several contradictions in its findings. The researcher has identified an evidence gap in prior studies, which are contradictory in their findings [Miles, 2017].
Knowledge Gap (Knowledge Void Gap)	Desired research findings do not exist [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017]. Primarily, the strategy utilized in the Sri Lankan context in the maintenance industry should be explored further such as government interventions to policies to provide an understanding of how it affects the socio-economic realm [Miles, 2017].
Practical-Knowledge Gap (Action-Knowledge Conflict Gap)	Professional behavior or practices deviate from research findings or are not covered by research [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017]. There appears to be a practical knowledge gap in the prior research. The prior literature lacks rigorous research on this topic. Some of these aforementioned articles appear to be lacking in the practice of a suitable area in the field, especially the factors in overcoming risk management, particularly how these companies

	used their strategies to sustain business during the COVID-19 Pandemic.
Theoretical Gap (Theory Application Void Gap)	Theory should be applied to specific research issues to generate new insights [Müller-Bloch & Kranz, 2014], [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017]. This is particularly seen in the factor of redefining the playing field i.e., what is the key difference between low growth maintenance companies and the high growth maintenance companies? There is a lack of theory, thus a gap exists.
Population Gap	Based on the review of the prior research, there is a population gap. Some of these sub-populations have been unexplored and under-researched. As per Figure 1, it appears to be important and worthy of investigation in the context of factors affecting sustainable maintenance engineering in different companies in South Asia [Miles, 2017].

Source: Author adapted from Robinson, Saldanhea, & McKoy (2011); Müller-Bloch & Kranz, (2015); Miles, (2017).

RESULTS AND DISCUSSIONS

Major Categories Of SCM Processes In CDL

An effective supply chain that aligns closely with a company's overall business strategy is essential for advancing organizational objectives and achieving long-term, profitable growth. While the strategic direction should inform supply chain design, success ultimately depends on efficient execution across all tactical dimensions. In the context of ship repair operations, these dimensions typically encompass four significant flow categories: product, information, finance, and commercial. At Colombo Dockyard Ltd. (CDL), the procurement process plays a central role in facilitating these flows, acting as a critical link between operational requirements and supplier capabilities. Analyzing the procurement process provides valuable insight into how information is exchanged and managed within CDL's supply chain, directly influencing performance outcomes such as cost efficiency, timely delivery, and material availability.

Procurement Process

Figure 4 describes the process for procuring materials in CDL. Individual factors are then described in more detail.

The aspects of Figure 4 are described below:

1. Vital Areas of the MOC: Material Ordering Card
   a. This card will provide the description/ Technical specification of the ordering materials
   b. Required date to be submitted by the planning team.
2. Purchase Enquiry (P/E)
   a. According to the current process, a minimum of 10 or more P/E s are sent for each item.
   b. Minimum 3 or more quotations are needed to proceed further, to compare the offers and choose the best deal.
   c. The purchase inquiry is directly linked to the cost factor.
3. Purchase Order
   a. Most vital document and legally enforceable document
   b. Currency code, Description, quantity, required date, delivery date, and shipping terms need to be specifically mentioned
   c. Shipping marks and numbers, warranty issued
   d. Signature of the head of the division

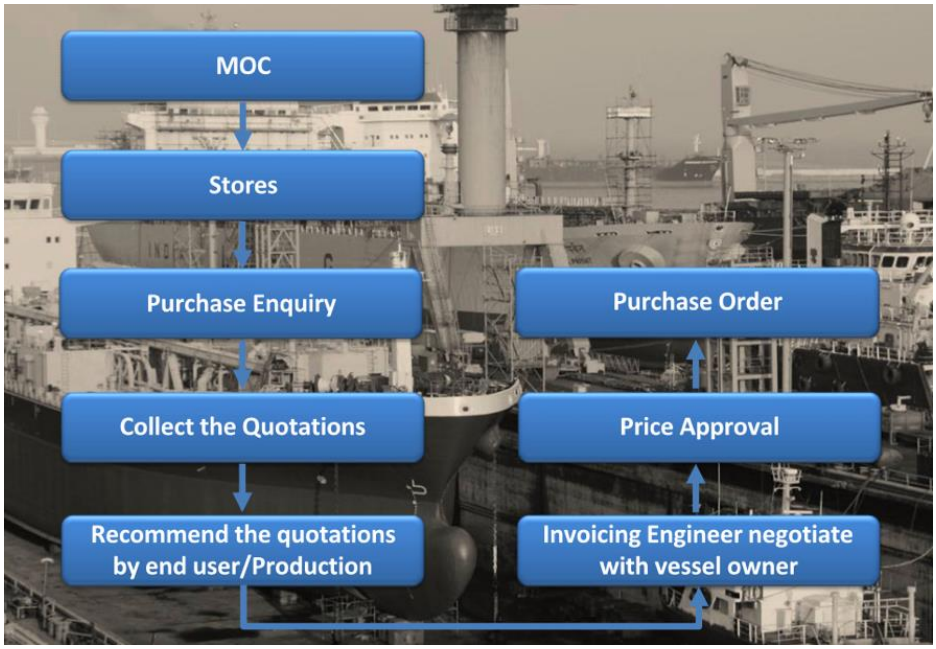

Figure 4. Material Ordering in CDL
Source: Adapted from Author

Payment Term:

1. Advance – T/T
2. Balance – Letter of credit
3. Credit – 30/60/90 days, etc
   a. *A Proforma invoice is compulsory to arrange any of the above payments except credit payment.*
   b. For Credit payment, a commercial invoice and a GRN are required to settle the payment.
      1) A letter of credit/ irrevocable letter of credit (LC/DC) cannot be cancelled or modified without the consent of the parties involved
      2) An irrevocable letter of credit is a guarantee from a bank, issued in the form of a letter. These letters allow companies (and individuals) to do business with confidence.

3) Letters of credit are frequently used in international trade as well as for domestic transactions. The details of each deal are not as important as the bank's involvement, which ensures financial operations are secure so that the "beneficiary" receives the payment when the deal is over.

Advance payment / LC Payment
1. Use a proforma invoice
2. Currency code, shipping term as per the PO
3. Once remitted, the T/T copy has to be sent to receive the acknowledgment.

Letter of credit
1. Bank-to-bank formats vary
2. Content is practically identical
3. This is a separate subject and recommendations from the superior/ experience specialist are essential while undertaking the actual task.

Challenges, Strategies & Risk Management on the Procurement at CDL

The Challenges faced in the industry are as follows:
1. Price fluctuations
2. Trustworthy sources
3. World economy
4. Changes to the project requirement
5. Natural disasters, local & foreign legal Barriers (TRC, defence, etc)

The strategies in place to counteract these challenges:
1. Finding reliable Sources with a competitive price.
2. Mutual relationships with suppliers
3. On time delivery (JIT –just in time)

Risk Management
1. • Changing delivery terms (Incoterms, 2010)
2. • Payment methods (LC)
3. • BG, Performance bond, agreements, etc

New trends in SCM in Ship Repair Yards
1. Global warming, eco-friendly, less material usage designs, minimum operations, and achieving economies of scale
2. AI (Artificial Intelligence) embedded for the SCM
3. RFID enhancement
4. Reverse logistics

CONCLUSIONS

This article examined the different types of literature in the sustainable vessel repairs sector, identified the research gaps and the characteristics that afflict researchers, and offered a theoretical framework that simplifies the concepts of research gaps in the industry. Factors in the global context have been analysed along with Sri Lankan companies in the present pandemic situation and some important results from this particular analysis may be emphasized as follows:

1. The Sri Lankan medium-sized shipyards are less competitive compared to their potential counterparts in the Asian market, particularly in intangible resources and the response to the external environment conditions.
2. It is vital to create sustainable competitiveness in the regional market, the national shipyards are recommended to implement intensive and integrative strategies.

The author suggests that scholars in this sector can conduct further research to analyze this segment for improvement, especially the influences on government policies and socio-economic factors

on this industry. As mentioned before, entry into this industry would be possible if more dockyards could be built along the coastline, as per the government regulation. This is not a trouble-free factor. Therefore, CDL can be a market leader in price. Exploring this industry through a resource-based view to identify potential competitive advantages would be a future research area to be developed from a supply chain perspective.

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