

Ship Routing Optimization among Brics Countries: A Literature Review

Author's Details: Pravendra Tyagi¹, Prof G. Agarwal²

¹ Ph.D. Research scholar, MNIT Jaipur

² Professor, MNIT Jaipur

ABSTRACT

Moving towards the vision of BRICS summit, it becomes mandatory to have prompt connectivity among this coined term, with initial effort to focus the contribution of researchers, towards immense area, logistics management and ship routing optimization among BRICS countries. This paper is an exploration of the issues and mitigations given by contributors in different relating areas, which are lacking in focus on trading enhancement through ship routing optimization between ports of BRICS countries, my efforts will be to overcome this limp by presenting a approach for effective ship routing with managed loading and unloading inventory at ports, according to planned sequence as well as distributing the goods to the desired destination with least operation cost between initial pick point to final drop point. Supply chain management encompasses the routing and scheduling of inventory maneuver to desired allocation in an economic mode for satisfying all end-users by prompt connectivity and communication between the links of supply chain.

Keywords: *Supply chain integration, BRICS, fragmented, logistics, constraints*

1. INTRODUCTION

Exploring the strategies implemented by the eminent contributors in the field of ship optimization and logistics management which indeed are concerned with the economic route selection for different sources to make them available on single track by managing the information through entire supply chain, to keep the BRICS countries able to overcome the challenges and scarcities. The next section of literature review, discusses the views of esteemed authors in the above stated field. Enhancing BRICS business community by economic momentum led by supply chain integration with consideration of negative and positive constellation from all aspects and it is fairly known that BRICS already accounted for one-quarter of world GDP, which is helpful to reinforce the BRICS over G7 advance economies by removing curbs in integration of coined term, because no individual country can withstands rigidly against myriads challenges and finally stumble, but Brazil, Russia, India, China, South Africa can face all barriers in internationalization.

2. LITERATURE REVIEW

2.1 Route Optimization

Contributions on routing optimization network can be requested in many literatures with specific province as minimization of total cost, maximization of benefit, and focus on shortest operational time. For instance, Ioannis et al. [1] developed a solution approach based on shortest path formulation with routing constraints to minimize the total transportation and handling costs along with accommodation of local improvement heuristic and primal-dual algorithm for manipulation of routing constraints and providing upper and lower bounds. Iris et al. [2] classified the decision problem that arise at container terminals, which results in more docking time at the port but in order to use these ships efficiently, large amount of containers have to loaded, unloaded and transshipped in a short time span with least use of costly equipments.

Amir et al. [3] accommodated environmental variable at each node and arc logistics independent variables to find the shortest path from upstream to downstream by applying stochastic dynamic programming. Mabel et al. [4] notified a problem in international shipping which combines the ship routing barriers with inventory considerations to minimize the total cost of transportation and inventory by using heuristics for good practical solutions. They considered two routing strategies often used in the shipping, the multiple ports of call (direct) other, the hub and spoke (transshipment)

system, direct ones can be viewed as a combination of the travelling salesman problem and the travelling repairman problem, other can be as one warehouse- multi retailer system for hub and spoke strategies to model the inventory cost in the system. Sanja Bauk et al. [5] proposed mathematical approach to Hopfield-Tank neural network for determining the optimal shipping route.

Patroklos et al. [6] analyzed the ad-hoc routing protocols and classified them in to five categories as asymmetric cryptography, symmetric cryptography, hybrid solutions, reputation based solutions and the last one is category of ad-on mechanism. Dick et al. [7] focused the supply chain management and optimization in forest industry to make wood available from forest to the miles by coordination of loggers and transporters and suggested that, synchronizing between supplier orientation and customer orientation is mandatory to achieve supply chain optimization and along with integral transparency between tactical and strategic planning to execute the short term and long term forecasting. Emad et al.[8] introduces evolutionary algorithms (stochastic search methods) that the natural biological evolution and the social behavior of species to arrive at near optimum solution to large scale optimization problems for which traditional mathematical technique may fail, he also compared the formulation and result of five recent evolutionary based algorithms: Genetic Algorithm, Memetic Algorithm, Particle Swarm, ant-colony system and shuffled frog leaping

Koichi et al. [9] formulated as a two stage problem by using Genetic Algorithms with consideration of empty container repositioning to design of liner shipping service networks. A new internet routing architecture design and evaluation has been presented by Xiaowei et al. [10] which addresses a efficient route representation fast route failover and security, also breaks an end to end route into receiver part and sender part with only a source and a destination address and routes are switched by switching addresses. Gonullu et al. [11] used a shortest path model based on geographic information system elements and Route view Pro software to optimize solid waste collection process as aimed was of minimized cost, also claimed the success by optimization process was around 4-59% for distance and 14-65% for time.

Luo Junhai et al. [12] presented the taxonomy of multicast routing protocols with their design features and properties, which is helpful for mobile ad-hoc network researchers in selecting appropriate multicast routing protocols for their work. Lector Vaidotas [13] implemented route optimization in municipal solid waste management to reduce empty miles and total expenditures. Zhongzhen Yang et al. [14] covered a new kind of shipping network that consists of trunk and feeder lines with bi-level programming model to minimize the transportation cost, resulting in optimization of container shipping network. C.Chitra et al. [15] explore use of non dominated sorting Genetic Algorithm for solving the shortest path routing problem by considering quality of service parameters, delay and cost objectives and further focusing the ability of multi objective evolutionary algorithms to find multiple pareto –optimal solution in one single run for solving problems with multiple and conflicting objective with the use of NSGA approach for dynamic routing optimization problem which is formulated as a nonlinear constrained multi objective optimization problem, where cost and delay are treated as competing objectives.

Rakesh Kumar et al. [16] implemented Genetic Algorithm to find the set of optimal routes to send traffic from source to destination, he also discussed about static and dynamic routing. If the routes between the nodes are pre-computed based on certain factors is known as static routing and when network sequence changes, dynamic routing is used. P. Calduwel newton et al. [17] identified and classified the route optimization mechanism and selected suitable RO protocol to enhance the quality of internet applications. Ming et al. [18] achieved the objectives such as warning and pre collision preparation by using the concept of e-navigation, path planning for positioning collision avoidance and applied an Ant colony Algorithm in the field of artificial intelligence for constructing a collision avoidance model that imitates optimization behavior in real life application.

Payman Jula et al. [19] proposed the least cost strategy where costs include costs for transportation and handling, pipeline inventory and safety stock by using mixed integer non-linear programming model for optimizing supply chain s of importers of water borne containerized goods from one end to other end. Khaled et al. [22] included constraints as delivery time windows

imposed by end-users, time horizon for deliveries and ship capacities for loading shipment problem, also develops an efficient variant of GA for ship routing and scheduling problem for comparing the proposed algorithm with exact method which uses set partitioning problem in terms of solution quality and computational time.

A system has been introduced by Saluka et al. [23] for planning routes for container carriers in an optimal manner by using Artificial intelligence, which takes initially the starting point and the destination point specified by the users, and then container carriers find the best suitable track to reach its goal destination avoiding all possible obstacles. P. Oddo et al. [24] used a modified Dijkstra algorithm for recovering shortest path and by accommodating time dependent meteorological field, a prototype for an operational ship routing decision support system has been presented by them. J.Szlapczynska [25] outlines the commercial application of multi criteria evolutionary weather routing algorithm and discusses the advantages of utilizing pareto front in case of route finding. Cesar et al. [26] attempts to synthesize a number of contributions that is limited to the level of inter-urban linkage, which poses theoretical and mathematical problems to model the structure and to analyze the dynamics of a system of cities, followed by a review of how urban and logistical elements have been integrated in more dynamical studies of networks.

Sopnamayee Acharya [27] implemented mathematical model and optimization based algorithm to minimize the total distance as the main objective with time window, that imposes the customer availability as a constraint for solving vehicle routing problem and allocation of shipments to vehicle. Maria et al. [35] provided a quantitative strategic decision support methodology for the design of globalised supply chain networks that identifies the optimal mixture of near shore/off shore production allocation capacity and the optimal port of entry into account free trade and sustainability related issues. Hyun et al. [36] focused the international multimodal transport to connect one or more adjoining countries for delivering cargos with assurance of delivery reliability while minimizing transit time and costs, also considered the economic standard vary from country to country, which can affect the routes performance, due to lack of interconnections, interoperability and legal framework while delivering cargos. In addition to this, Hyun

proposes a decision-aid tool within a decision support system using Fuzzy-AHP for the systematic analysis.

Srecko et al. [30] developed an algorithm for transport planning on a voyage route with multiple loading ports, unloading ports and named it minimum cost multi commodity flow problem (MCMCF) and this algorithm is also applicable to find appropriate load planning sequence and to ensure minimal loading, unloading and transshipment cost with fulfillment of cargo demands to concerned ports on the voyage route. Martins et al. [31] proposed a logistics model for short sea shipping that greatly increase flexibility and that may reduce costs substantially to overcome the challenges in optimal route selection, optimal distribution of cargo and optimal cargo stowage plan using Genetic Algorithm.

Chandrasekaran et al. [32] proposed the practical case study based on supply chain network using Genetic Algorithm by considering the capacity, inventory balancing and demand constraints at various stages of the supply chain to represent a mathematical model solved by GA, with dynamic of single product being manufactured out of three component, three suppliers, two manufacturing plants, three distribution centers, six retailers. Hariloos N. et al. [33] exercised on liner shipping costs and tries to identify key variables and their affect on costs, which are ship size, speed, port time, route distance, and bunker costs.

2.2 Loading Unloading Optimization

Mads K et al. [20] proposed a model that emphasizes on delivery capacity, cost effectiveness and environmentally conscious transport solutions with consideration of vehicle routing problem using dynamic programming. Xueping Wang et al. [21] used multistage decision and algorithm of the mathematical model for setting up the T stage decision making paradigm of loading and unloading line equipment, also provided the scientific basis for the decision of type selection. Liu Aizhen et al. [28] built the mathematical model with bi-objective of cost and loading time based on Genetic Algorithm to get the optimum balance between cost and loading time of missiles.

Rao Pino et al. [29] implemented Genetic Algorithm to the container loading problem to maximize the cargo shipment capacity with loading

restrictions, in order to achieve a reduction in costs. D. Aprile et al. [37] aimed to provide link between loading and routing problem and developed methodology for vehicle routing problem with loading constraints, based on Simulated Annealing. Richa et al. [34] presented integrated model with mixed integer linear program for solving ship scheduling and the cargo routing problem with constraints such as weekly frequency, transshipment of cargo between two or more service route.

of each country as Brazil [B1,B2,B3,B4], Russia [R1,R2,R3,R4], India [I1,I2,I3,I4], China [C1,C2,C3,C4] and South Africa [S1,S2,S3,S4] ,also four cites of each country assume a central agency ,let say “A” that is having “S” {1,.....,s} number of cargo ship with loading capacity of $Q_1, Q_2, Q_3, Q_4, \dots, Q_s$.

Total cost includes.

$$TC = RCS + LCN + ULN + WCS + CMP + CPD$$

3. PROBLEM DEFINITION

The BRICS members are all developing or newly industrialised countries, but they are distinguished by their large, fast-growing economies and significant influence on regional and global affairs. The coined term enhance towards emerging power, maximum trading among them with their local currencies, even though each nation must have their own export-import trading policies, network, route and protocols. According to today's economical surveys, BRICS nations have already secured a place because of their market opportunities and planned to achieve global stability with Security and prosperity or in other sense establish a more balanced and inclusive world by expanding cooperation and sharing knowledge in the area of national security, finance, agriculture, health, trade and education (BRICS Summit).

Therefore intra shipping route optimization among BRICS is a void, which will play a very important role in terms of trading capacity, policies, new market for business domains, job opportunities and linked demand and professional issues. In our study we have to manage logistic among BRICS countries so that goods can be transported within optimized path with maximum delivery and minimum transportation cost within minimum time or to find the optimal ships routing with minimum total cost between source node N_s and destination node N_d . For this purpose we are taking four ports

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- a) CMP : Acquiring cost (Manufacturer to port)
- b) RCS : Transshipment cost (Port to Port)
- LCN & ULN: Loading and Unloading cost.
- WCS : Waiting cost of ship/day
- CPD : Distribution cost (Port to Distribution center)

CONCLUSION

Enhancing the work in same province with different nodes it becomes necessary to know about the efforts which can be accommodated in the previous segment and results in innovative paradigm for making challenges handy. My impetus addresses the narrative imparted by the researches in the field of logistics and shipping route optimization which is very beneficial for me to carry work in same direction but with new aspects. Serving for researchers about the obstacles and constraints to integrate sources and articles of trade chain among BRICS countries, this paper contributes vision of majority, towards supply chain integration which clearly makes aware about individual country; aspects of SCI but now further, will be going on joining all the five countries to a single entity resources sinuous path

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