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Supply Chain Integration and Logistics Management among BRICS: A Literature Review

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Abstract: - Supply chain management encompasses the routing and scheduling of inventory maneuver to desired allocation in an economic mode for satisfying the all end-users by prompt connectivity and communication between the links of supply chain. In this article efforts have been made to explore the series of challenges in BRICS countries in supply chain connectivity to achieve the revolution of coined word, which is "Broad vision and shared prosperity, also security and prosperity" this paper exposes the impacting key constraints on economic and smooth supply chain execution country wise, specifically Brazil, Russia, India, China, South Africa, also discusses the approaches to overcome the loose poles in supply chain system by enhancing internationalization and globalization ,which relates to quantitative and qualitative strengthening in the field of finance and technology.

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

I. INTRODUCTION

In the current scenario BRICS has come in existence as a very important group in terms of many economic and demographic parameters, Holly A. Bell [31]. BRICS now constitutes the fastest-growing, largest emerging-markets economies and account for just half of the world's total population. They have increasing share in GDP, FDI, and might have a huge impact in shaping and enhancing future economic and world dynamics, Yunyun Duan [26]. Tracking towards the vision (shared prosperity, global stability) of BRICS summit, it's mandatory to know about the challenges in above countries individually before achieving the target "Supply chain integration" which covers different concerning challenges and culture to cast into single coined term. Supply chain integration (SCI) is immense area and have chosen a specific province which emphasizes about knowing the barriers and obstacles in integrating the BRICS for trading enhancement and unified solution and this paper gives the initial platform for me to move further for shipping routing optimization among BRICS countries by GA (Genetic Algorithm) in my next paper.

1.1 Supply Chain Integration Definition

Supply chain encircles the activities beginning from purchasing, procurement, manufacturing operations, production scheduling, inventory control, material management, and facility location planning and information technology by coordinating between supplier, manufacturer, retailers and end-users. SCI speculates the physical nodes (plants, warehouse, supplier, ports), Transportations modes (Trucks, Train, Cargo planes, Container Ship), Logistics (Management of entire supply chain) to earn the customer response and gratification.

II. LITERATURE REVIEW

Exhaustive literature review is mandatory to cusp the researchers contributions in the concerned field to initiate the new developments and creations questing so In same context my efforts are highlighting the key vision of previous contributors and forecasters.

2.1 Supply Chain Integration

Marcos Fava et al. [1] discussed the chain transaction, mainly between fruit growers and processing industry with the consideration of theoretical background of supply chain management in a transaction cost economic approach. Rodney et al. [2] served a integrated business process model, which highlights the

importance of communication between processes and partners in the supply chain for gaining competitive advantage by optimizing global supply chain efficiency. Markham et al. [3] investigated sample of manufacturers globally for providing supplier and customer integration strategies by characterizing each of these as an arc of integration with customer and suppliers, which has strongest association with performance improvement.

Togar et al. [4] established a comprehensive taxonomy of coordination modes, which are logistics synchronization, information sharing, collective learning and incentive alignment to have positive impacts on supply chain performance. Chong Liu et al. [8] minimized the total freight transport cost in the city by optimizing the size and spatial distribution of city logistics terminals with location model and Genetic Algorithm, along with the modeling of choice behavior of retailing facilities. A. Gunasekaran et al. [19] attached the importance of build-to-order supply chain management strategy and its role in improving the competitiveness of an organization, explored the objective of BOSC in the term of meeting individual customer requirements, by leveraging the advantage of outsourcing and information technology. Luiz et al. [10] to review the literature concerning reference models that operate different information system for the effective supply chain, systems are decision levels (the vertical axis) and supply chain business processes (the horizontal axis).

Peter Trkman et al. [14] combined the utilization of information technology, simulation and business process modeling for improving supply chain performance followed by simulation methodology. Taco Van et al. [15] explored the supply chain integration with individual buyer –supplier relationship and examined the impact of this relationship on supply chain performance. Kevin et al [18] investigated the relationship between supply chain maturity and performance, by showing the higher impact of delivery process maturity on overall performance than other supply chain process, further examined the evolution of performance measurement systems, and presenting the main empirical contributions through the use of the business process maturity model and supply chain operation reference model. Jonas et al. [21] came to know about industrial structural changes like product design changes, deal and setup of new productive chain, lean manufacturing adoption and analyzing implementation of logistics and supply chain management in the industry, also illustrating the relationship and mutual influence that exists between these area. Hussain et al. [23] integrated all supply chain integration challenges in one source to enhance supply chain management performance and in the same year Mohammad Othman Nassar et al. [24] further contributed two things based on supply chain integration literature, firstly delivering all supply chain integration challenges in an organized and complete manner, secondly providing a classification that encompasses all the supply chain integration challenges.

An attempt has been made by James A et al. [27] applied porter's Diamond framework to assess the strength and weaknesses of the processed citrus industry in each country to confront the combined challenge of effectively combating these diseases while maintaining market competiveness, Porter's Diamond framework reveals that there are organizational structure of the industry. Rana Basu et al [28] accommodated and prioritized the risk factors in context to supply chain management in Indian manufacturing organization to mitigate the risk issues so as to maintain the smooth operation of supply chain. Haresh et al. [29] proposed to investigate the types and management of risks faced within the supply chain functions and also creates investigation strategies for dealing with these risk and resulted from rapid development in science and technology, organizational changes, raw material shortage, short product life.

Chaman Singh et al. [30] introduced expression for the average inventory cost in crisp and fuzzy sense. Waldermiro et al [33] exposed the two bottlenecks, in the Brazilian industrial sector one is emphasis on coordination rather than integration in supply chain management and other is insufficient channel of communication between private and public sectors, resulting in inefficient policies to nature automakers with low production volume. Jawahar Babu [34] identified, 'integrating the entire supply chain and managing it as a single entity inbound logistics are identified as key challenged involved in supply chain. Due to globalization industries have been undergoing tremendous changes and exploring exhaustive effort to reduce operating cost, lead time and inventory to grab the growth in the world. Natalia Volgina [50] provided an overview of the major trends taking place in Russian industries with a special emphasis on the structure of the automotive value chain and trends in global automotive industry and suggested that Russia needs to change the current vertical specialization of Russian original equipment supplier and enhance localization of foreign manufacturers.

2.2 Logistic Management

Markus et al. [5] considered the logistics as a core component of transport geography and provided an overview of the freight distribution in connection to traditional perspective with transportation as a part of an integrated demand. Khalid Bichou et al. [6] suggested a relevant framework of port performance through logistics and supply chain management approach through conceptualizing ports. Hajnal et al. [11] implemented discrete event simulation software to carry optimization in a food distribution centre by introducing process, process equations, process variables and network of process. Michelle et al. [12] proposed one tactic to get best logistics performance is, to establish consolidation hubs that collect shipments from several vendors and

distribute to manufacturing plants, with the help of network design concept and integer linear optimization model.

Patrik et al. [13] Conducted data based analysis in Nordic countries to report and reflect on the characteristics of academic discipline concerned with logistics and supply chain management. Nathalie Fabbe [16] analyzed the fundamental platform for logistics and supply chain management by providing link between supply chain integration and performance. Khalid et al. [20] used Ant colony algorithm system in optimizing fleet routing of an actual international courier business willing to enhance quality of service delivered and to reduce its cost. Mauro Catalni [22] proposed methodology based on computation program to optimize maritime transport routing of a containership by geographical information system. Hui Li et al. [37] constructed two business models, firstly traditional disintegrated and secondly load logistics partner integrated by optimization model of logistics strategy with implementation of Genetic Algorithm. Sayedyaser Bozorgirad et al. [39] proposed route based Genetic Algorithms to minimize cost of multi product-multi source flexible multistage logistics networks.

Sahidah Zakariah et al. [40] focused challenges of logistics management and accounting based on content analysis (at macro level and survey analysis (at micro level). Okan et al. [42] presented extensive review based on current state and future of shipping and logistics, exploring major topics as, maritime, policies, transport networks, ship management and logistics research. Sae-Yeon et al. [43] considered business focused application of multi-criteria location problem for making humanitarian relief organization by pre-positioning of warehouses, followed by national stability, cost, logistics and location. Harsh et al. [44] gives an outcome of a simulated project which focused on goods transport planning agendas faced by major corporate clients, with the involvement of integrated logistics management, which does not guarantee low cost but assures overall reduction in per unit cost by way of optimizing warehousing and transportation requirement. Paulo et al. [48] considered the cargo distribution and delivery deadlines to improve short sea shipping flexibility by logistics model and a mathematical model that determines the port to visit, how to stow on board and which containers to embark.

2.3 Supply Chain Optimization

Ruth Banomyong [7] discussed the issue of security and supply chains, also investigates container security initiative and its impact in financing implications. Fashima et al. [17] extended the previous production-distribution model by mixed integer formulation with integration of aggregate production plan and distribution plan. E.Silarbi et al. [36] placed a mathematical model that solves the optimization problem based on durations and costs in executing and delivering the customers orders with considerations of constraints such as suppliers and manufacturers capacity to find a near optimal solution to minimize cost and time along the whole supply chain process.

Zhen et al. [38] focused on mathematical model based on particle swarm optimization for reverse and forward logistical strategies in multi stage system. Joseph et al.[46] addressed about the route selection within the given supply nodes to facilitate the third party logistics provider to minimize the total cost of transportations and inventory along with customer requirement fulfillment by using the optimization technique to conclude the minimum cost of logistics and inventory holding cost. Rajeshwar [41] implemented particle swarm optimization to optimize four stages supply chain structure, which includes vendors, manufacturing plants, warehouses and distribution centers, with the help of a tactical level model, which considers an integrated, multi component, multistage, single product and procurement –production-distribution system design problem.

III. 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 withSecurity 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 Ns and destination node Nd. For this purpose we are taking four ports 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..... , Q_s.

Total cost includes.

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

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

3.1 Notation of Variables

a) S = {1… s} Set of s ships to be scheduled.
b) P = {1… p} Set of p ports that could be visited.
c) N = {1,…..,nmax} Set of n containers , nmax is the total no of containers to be delivered.
d) Dij = Distance between ports i and j in days.
e) Qp = Port capacity in tons/TEU
f) Qs = Ship capacity in tons/TEU
g) Qf = Freight quantity to be shipped in tons/TEU
h) Wn =Total weight of a container in tons
i) Vs = Ship speed in knots
j) tli = Loading time of container on ship at port i
k) tui = Unloading time of container from ship at port i
l) tws = Waiting time of ship (ship is static in ocean)
m) tbi = Unloading Beginning time of container at port i
n) tei = Unloading ending time of container at port i
o) ßijs = { 1, if ship s sailing from port i to j ,otherwise 0

IV. MATHEMATICAL FORMULATION.

Objective function

$$f(x) = \sum_{s=1}^{S} RC_s + \sum_{N=1}^{P} LC_N + \sum_{N=1}^{P} UC_N + \sum_{S=1}^{S} wC_s + \sum_{P=1}^{P}\sum_{M=1}^{M} C_{MP} + \sum_{P=1}^{P}\sum_{D=1}^{D} C_{PD}$$

Subject to

Qf = ≤ Qs {Freight quantity must be equal to the ship Capacity}

tj = ≤ ti + tui + tij {Arrival time between two consecutive Ports}

Unloading time window

tbi ≤ tui ≤ tei

tui ≥ 0

V. DATA COLLECTION

Distance between Major Cities and Major Ports of Brazil

From /To	Belem B1	Fortaleza B2	Paranagua B3	Recife B4
Brasília	1939 km	2106 km	1426 km	2133 km
São Paulo	2648 km	2969 km	447 km	2,648 km
Rio de Janeiro	2299 km	2620 km	890 km	2,299 km
Belo Horizonte	2028km	2349 km	1,034 km	2,028 km
Salvador	805 km	1227 km	2,420 km	805 km

Source:-Google maps.Com, glorier online.com, The Brazil Business.com

Distance between Major Cities and Major Ports of China

From /To	Zhanjiang C1	Bahezhen C2	Port of Xiamen C3	Port of Tianjin C4
Shanghai	1898 km	844 km	1035 km	1109 km
Beijing	2568 km	1147 km	2113 km	140 km
Shenzhen	506 km	1027 km	609 km	2164 km

Suzhou	1865 km	744 km	1021 km	1016 km
Guangzhou	420 km	1018 km	706 km	2155 km

Source: - Google maps.Com, peopledaily.com, wiki.answer.com

Distance between Major Cities and Major Ports of Russia

From /To	Kaliningrad R1	Poronaysk R2	Azov R3	Naryan-Mar R4
Moscow	1188 km	9425 km	1115 km	2389 km
Samara	2279 km	8503 km	1356 km	2330 km
Yekaterinburg	2965 km	7696 km	2288 km	2019 km
Saint Petersburg	877 km	9918 km	1821 km	2576 km
Nizhny Novgorod	1665 km	9022 km	1248 km	2217 km

Source: - Google maps.Com, www.dating-world.net,www.globalports.com

Distance between Major Cities and Major Ports of South Africa

From /To	Cape town S1	Port Elizabeth S2	East London S3	Richard Bay S4
Durban	1640 km	911 km	655 km	178 km
Free state	1111 km	775 km	672 km	711 km
Gauteng	1403 km	1067 km	964 km	615 km
Eastern cap	919 km	300 km	228km	871km

Source: - Google maps.Com, http://www.howwemadeitinafrica.com

Distance between Major Cities and Major Ports of India

From /To	Mumbai I1	Vishakhapatnam I2	Chennai I3	Cochin I4
Ankleshwar	337 km	1544 km	1647 km	1848 km
Vapi	180 km	1507 km	1491 km	1215 km
Ghaziabad	1442 km	1683 km	2154 km	2667 km
Chandrapur	914 km	700 km	961 km	1527 km

Source: - Google maps.Com, http://gsuryalss.wordpress.com

VI. CONCLUSION

The exhaustive review conducted above is helpful to make familiar about individual challenges faced by BRICS countries, which further support for integration of supply chain in attaining sustainability in all aspects. This paper extends the BRICS status towards clear picture of lacking in different areas of concerned country but further my efforts will continue to provide solution regarding above stated scarcities to make successful integration of coined countries, with the help of literature reviews, data collection, and optimization technique followed by software tool. The efforts made in this study will aim to unify different nations globally. The insufficiency of various countries in their province will be sufficed only when a step will be taken forward towards integration. To overcome the deficiency of one country, in the moment of crisis, with the strength of remaining Countries from group, this idea has been put forth

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