

Review of Improvement and Prevent Bridges from Contributing to the Nation's Supply Chain Problem

Kailash Nath Bhagat, Prof. Shashikant B. Dhobale

Department of Transportation Engineering,
Jawaharlal Institute of Technology,
Borawan Dist. Khargone (M.P)

Abstract- Successful highway transportation must address three areas of consideration: (1) creative and aesthetic, (2) analytical, and (3) technical and practical considerations. Given that most bridge transportation today are performed by multidisciplinary teams, addressing the first two considerations is fairly easy to achieve. The last is often the most challenging. This WORK discusses the practical challenges associated in the selection of Highway Bridge, the bridge types that are available for use and their range of applicability, the methods of analysis used, the dominant Supply in use today, and, finally, an example based on the AI of a bridge design following the practical considerations given here.

Keywords- highway, transportation, Bridge type selection, Supply Chain Analysis methods.

I. INTRODUCTION

Our Country is entering a very serious, dangerous, and complicated time in the transportation and infrastructure industry. Motorists are becoming increasingly more frustrated with travel delays that are caused by roadway maintenance projects and expect that free-flow traffic should occur 24 hours a day. Motorists now understand that commuting traffic typically occurs between 7–9 am and 4–7 pm during the week and has become a given. During other times of the day during the week, and throughout the weekends, motorists using our roads and bridges expect to be able to travel those roads and bridges in a relatively free-flow situation. They trust that the roadways are safe and sound – and that the bridges they are driving over will not fall down.

Unfortunately, the reality is that a very large percentage of bridges on the public road system in the United States are aging well beyond their expected 50-year life span. A substantial percentage of bridges are approaching 65 years old and, within the next few years, over 25% of the country's bridges will be 65 years old and will have exceeded their 50-year lifespan by more than 15-20 years. Traffic Engineers and Transportation Planners, as well as others in the engineering profession, are going to be called upon time and time again to, very quickly, design road and bridge projects that will cause substantial delays to the motoring public once they begin reconstruction.

There was a point in time when only the travel lanes or the surface of the bridge needed to be reconstructed. That, in and of itself, created a challenge as it relates to maintaining traffic throughout the day and throughout the week. The challenge we now face as a country is vastly more difficult. Not only is the travel surface or the pavement of the bridges failing, but the substructure and

the superstructure (the columns and the bridge piers and the steel) are beginning to fail at an alarming rate.

II. SUPPLY CHAIN MANAGEMENT

In commerce, **supply chain management (SCM)** deals with a system of procurement (purchasing raw materials/components), operations management (ensuring the production of high-quality products at high speed with good flexibility and low production cost), logistics and marketing channels so that the raw materials can be converted into a finished product and delivered to the end customer.[2][3] A more narrow definition of the supply chain management is the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronising supply with demand and measuring performance globally".[4][5]

This can include the movement and storage of raw materials, work-in-process inventory, finished goods, and end to end order fulfilment from the point of origin to the point of consumption. Interconnected, interrelated or interlinked networks, channels and node businesses combine in the provision of products and services required by end customers in a supply chain.[6]

Supply chain management strives for an integrated, multidisciplinary, multimethod approach.[7] Marketing channels play an important role in supply-chain management.[8] Current research in supply-chain management is concerned with topics related to sustainability and risk management,[9] among others. An important concept discussed in SCM is supply chain resilience. Some suggest that the "people dimension" of SCM, ethical issues, internal integration, transparency/

visibility, and human capital/talent management are topics that have, so far, been underrepresented on the research agenda.[10] SCM is the broad range of activities required to plan, control and execute a product's flow from materials to production to distribution in the most economical way possible. SCM encompasses the integrated planning and execution of processes required to optimize the flow of materials, information and capital in functions that broadly include demand planning, sourcing, production, inventory management and logistics—or storage and transportation.[11]

Although it has the same goals as supply chain engineering, supply chain management is focused on a more traditional management and business based approach, whereas supply chain engineering is focused on a mathematical model based one.[12]

III. ECONOMIC IMPACTS

- Bridges are used for shipping raw materials and goods. You can move them to different factories, warehouses, suppliers, distributors, stores and many more. Bridges can be used for travel purposes too. Purchasing goods and services are another economical impact of bridges.
- Wages earned after a bridge is built goes to the development arena. It easily pays off more than investment. It helps a nation's economy to grow higher than ever. Maintenance workers get facilities in this case. They can buy things to invest in local business.
- Bridges build an excellent relationship between where there is good money there are authentic goods. One place supplies goods and other pays off well for that stuff. Here is an exchange of power. This way a bond is built between workers and investors. Raw materials are transferred to industrial areas in the easiest way.
- When a bridge is built it might cause you initial problems but later, big transports can use it, so there are less accident, fewer traffic jams, and less pollution. Even in case of passing of any ambulance bridges play a significant role. Bridges have different routes. This way it is easy to reach in time.

IV. LITERATURE REVIEW

Darren J. Prokop, Transportation and supply chain management: This chapter covers the role of transportation in determining supply chain efficiency. The effects of transportation operations on consignor decision-making are discussed. This includes value-adding activities such as procurement, production, inventory management, and distribution. Each of these activities requires adjustments to be made to transportation provision. Of course, as both a transaction cost and source of value-add, the nature of the transportation market can also provide feedback effects to these activities. Shipper-

carrier relationships are examined within the context of bills of lading. Third-party logistics providers (3PLs) are also examined for their effects on transportation market efficiency. Apart from efficiency, the role of supply chain resiliency through building in redundancy is also discussed.

Lila Rajabion, A new model for assessing the impact of the urban intelligent transportation system, farmers' knowledge and business processes on the success of green supply chain management system for urban distribution of agricultural products: Today, in urban planning, the role of an efficient Supply Chain Management (SCM) system is very important. Also, Green SCN (GSCM) because of its inherent capabilities such as faster delivery of goods and services, reduced latency, increased quality, value-added for customers to supply clean products and improve the organization's economic performance becomes very popular. Recently, GSCM has become one of the most important approaches in supply chain. Supply chain and urban managers through the logistic process try to get benefit from GSCM and improve their environmental performance as a valuable resource. The results of these measures save and eliminate excess energy and reduce operational points that are consistent with the green supply chain. The green supply chain also helps to distribute crops using urban ITS. This research presents a model for assessing the impact of urban ITS, farmers' knowledge and business processes on the success of GSCM systems for urban distribution of an agricultural product. The structural equation modeling method is employed to assess the causal model and to verify its validity and reliability. Also, the evaluation of the consistency and validity of the model is done through a structural equation model. The model and data based on the questionnaire are analyzed using Smart PLS 3.0. The collected results have shown that all the considered factors, urban intelligent transportation system, farmers' knowledge, and business processes play an important role in the success of GSCM for urban distribution of the agricultural product.

Chaoyu Li, A system dynamics simulation model of chemical supply chain transportation risk management systems: Unforeseen events can interrupt the operational process and have a negative impact on the chemical supply chain transportation (CSCT) system. A number of research studies have addressed the risk management issues in chemical supply chain (CSC) or CSCT. However, most of the existing methodologies lack inbuilt and practical techniques that take into consideration the complex interactions and dynamic feedback effects, which can significantly affect the reliability of risk management outcomes.

Alexander M. Niziolek , Municipal solid waste to liquid transportation fuels – Part III: An optimization-based nationwide supply chain management framework: An

optimization-based supply chain management framework for municipal solid waste (MSW) to liquid transportation fuels (WTL) processes is presented. First, a thorough analysis of landfill operations and annual amounts of MSW that are deposited across the contiguous United States is conducted and compared with similar studies. A quantitative supply chain framework that simultaneously accounts for the upstream and downstream WTL value chain operations is then presented. A large-scale mixed-integer linear optimization model that captures the interactions among MSW feedstock availabilities and locations, WTL refinery locations, and product delivery locations and demand capacities is described.

Xiang Ji, Eco-design of transportation in sustainable supply chain management: A DEA-like method: This study addresses the issue of eco-design for transportation in sustainable supply chain management (SSCM). Data envelopment analysis (DEA) is adopted and extended to construct a model for this application. This proposed model, together with the tractable algorithm developed in this research, can provide stakeholders with a Pareto Optimal transportation strategy. This derived transportation strategy can help stakeholders realize certain transportation goals with less resource consumption and pollution emission. The discussion presented leads to a heuristic Joint Transportation Policy and concludes with two useful suggestions for putting the strategy into practice. The proposed model was used in an empirical study of design sustainable transportation mechanism for one air-condition manufacturer in China to transport its products as well, the analysis further demonstrating the theoretical and practical value of this research.

Xu Shida, Optimisation of partial collaborative transportation scheduling in supply chain management with 3PL using ACO: In this paper, we study and analyze the characteristics of transportation vehicle scheduling problem in supply chain management with third party logistics enterprise. First, we subdivide all the transportation nodes into three distinct classifications. A novel partial collaborative transportation scheduling strategy is proposed based on two special kinds of transportation nodes which have integrated the self-support vehicle and 3PL vehicle resource.

Felix T.S. Chan, The impact of Collaborative Transportation Management on supply chain performance: A simulation approach: Collaborative Transportation Management (CTM) is based on the interaction and collaboration between trading partners and carriers participated in the supply chain, appropriate application of CTM can improve the flexibility in the physical distribution and minimize the inefficiency of supply chain management. This paper proposes new concepts of CTM and carriers' flexibility. A simulation approach is used to (i) evaluate the benefits of the

proposed CTM, (ii) explain the concept of carrier's flexibility, and (iii) optimize the delivery speed capability.

David Bogataj, Age management of transportation workers in global supply chains: Because of increasing longevity and aging of the population in most EU countries, the fiscal pressure influence increasing of retirement age in public pension systems also for physically demanding jobs like the retirement of drivers, acting in the transport of items. In many countries, the average employment rate of people aged 55 to 64 years increased over 7 percentage points in the decade. But large trucks which serve a vital function in JIT delivery in global supply chains, are a disadvantage in terms of safety and exact timing. It is also important to note that older drivers are more vulnerable to serious injury and death in the event of a traffic crash due to changes in physiology associated with normal aging. Vision, cognition, and motor functions like flexibility, strength, and coordination, are required for safe and not delayed driving, but they are part of overall declining of functional capacities after the 50s. To solve this problem, we should put in place the early retirement of the occupational pension schemes, in which higher retirement age will not affect the reliability of logistic and therefore will not influence the ripple effect of the total logistic network. This paper is introducing an actuarial evaluation of optimal retirement age and related economically acceptable contribution rate to the occupational pension scheme for drivers regarding exposure to the risk of the total chain. The model is based on actuarial mathematics for pension insurance. Therefore, the Net Present Value (NPV) is calculated in the extended MRP model to evaluate delays and disruptions caused by ageing.

Majid Azadi, Reprint of "Planning in feasible region by two-stage target-setting DEA methods: An application in green supply chain management of public transportation service providers": To meet green supply chain management's requirements of a company and its transportation service providers (TSPs), it is essential to set clear, achievable, and realistic targets. This paper proposes two data envelopment analysis (DEA) approaches to find targets for two-stage network structures. The objective of proposed approaches is to plan in feasible region. The feasible region specifies bounds to ensure targets are within current operational capacity of TSPs. Applying the approaches to set targets for 24 TSPs lead to different results. However, proposed models ensure that the TSPs would be efficient in their current capacity.

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Jae-Hun Kang, Yeong-Dae Kim, Coordination of inventory and transportation managements in a two-level supply chain: In this study, we consider a two-level supply chain in which a supplier serves a group of retailers in a given geographic region and determines a replenishment plan for each retailer by using the information on demands of final customers and inventory levels of the retailers. Deliveries are carried out by homogeneous vehicles with a finite capacity, and each vehicle can visit multiple retailers in a single trip. The problem considered here is to determine the replenishment quantities and timing for the retailers as well as the amount of products delivered to the retailers by each vehicle for the objective of minimizing the sum of the fixed vehicle cost, retailer-dependent material handling cost, and inventory holding cost of the whole supply chain. We develop heuristic algorithms by simultaneously considering inventory and transportation decisions. A series of computational tests are performed for evaluation of the performance of the heuristic algorithms, and results show that the heuristic algorithms give good solutions in a reasonably short computation time.

Kun-Jen Chung, The integrated inventory model with the transportation cost and two-level trade credit in supply chain management: The integrated inventory models usually have the advantage of reducing total cost. In the modern global competitive market, the supplier and retailer should be treated as strategic partners in the supply chain with a long-term cooperative relationship. Goyal [1] was probably the first researcher to develop the seller–customer inventory model. Recently, numerous researchers developed integrated inventory models under various assumptions. For example, Rau and Ouyang [2] presented an integrated production–inventory policy under a finite planning horizon and a linear trend in demand.

Ho et al. [3] developed an integrated supplier–buyer inventory model with the assumption that the market demand is sensitive to the retail price and the supplier adopts a trade credit policy. Ouyang et al. [4] explored an optimization approach for joint pricing and ordering problem in an integrated inventory system.

Kaneberg Elvira, Hydrogen technology for supply chain sustainability: The Mexican transportation impacts on society: This study sheds light on the Hydrogen technology in transportation for reaching the sustainability goals of societies, illustrated by the case of

Mexico. In terms of the affected supply chains the study explores how the packaging and distribution of a fuel-saving tool that allows the adoption of hydrogen as complementary energy for maritime transportation to improve economic and environmental performance in Mexico. This exploratory study performs interviews, observations, simulations, and tests involving producers, suppliers, and users at 26 ports in Mexico.

Hongyu Qian, Integrated inventory and transportation management with stochastic demands: A scenario-based economic model predictive control approach: The integration of inventory and transportation operations is a challenging task in multi-echelon supply chain management. Uncertainties in customer demands can have serious consequences, such as inventory fluctuations and transportation changes. Policies of integrated inventory and transportation management aim to find a balance between supply and demand and can minimize the total operating cost for the entire supply chain. In this study, we propose a scenario-based economic model predictive control (EMPC) framework for integrated inventory and transportation management of multi-echelon supply chains with stochastic demands. The proposed scenario-based EMPC framework can provide real-time optimal operations for automated inventory and transportation management with a minimum operating cost and a guaranteed risk probability.

HmamedHala, Machine Learning For the Future Integration of the Circular Economy in Waste Transportation and Treatment Supply Chain: Machine-learning technologies are key enablers to enhance the circularity in smart supply chain distributions. The digital and sustainable supply chain is a tangible representation of circular economy future growth that takes environmental challenges, by reducing materials consumption for manufacturing and reducing transportation emissions. Yet, machine learning, circular economy and digital supply chain are novel disciplines. There is limited research to fully acknowledge the promise of circular approaches in the context for waste treatment and transportation.

To fill in this gap, this study investigates the integration of circularity using machine-learning techniques for waste treatment supply chain. Resulting in a circular economy framework that integrate several tools and concepts, which will assists manufacturers in implementing circular solutions for waste and leachate treatment and transportation. The aim of the study is to present the idea of the approach application of the opportunities offered by digital technologies and the circularity for waste processing organizations in term of their smart supply chain management. The proposed framework may be handy for practitioners to develop coordinating operations throughout waste treatment supply chain, with the circular economy concepts and digital technology opportunities.

Jin Peng, Transportation planning for sustainable supply chain network using big data technology: The popularization of big data technology has a great impact on decision-making and optimization of a sustainable supply chain network. An integrated transportation planning and product retailing decision is a typical optimization problem in the sustainable supply chain network, especially in the setting of subjective uncertainty. Carbon regulatory and environmental changes around the world, as well as growing consumer concerns about carbon emissions, are forcing supply chain managers to redefine carbon emissions. This paper uses big data technology to investigate an integrated transportation planning and retailing optimization problem of supply chain network under different carbon regulatory policies.

Moh'dAnwer AL-Shboul, An investigation of transportation logistics strategy on manufacturing supply chain responsiveness in developing countries: the mediating role of delivery reliability and delivery speed: This study aims to investigate and examine the impact of delivery reliability (DR) and delivery speed (DS) on the relationship between a manufacturing firm's transportation logistics strategy (TLS) and supply chain responsiveness (SCR). Furthermore, it examines the impacts of SCR on manufacturing firm performance (MFP). A quantitative methodology was used for the purposes of gathering and analysing primary data for this empirical study, which included 212 participants in large-sized manufacturing firms in the Middle East Territory. A web-based survey was used for the data gathering process and applied after conducting a small pilot study. The conceptual model was tested by using a hypothesis-testing deductive approach.

M.S. Al-Ashhab, Multi-objective sustainable supply chain network design and planning considering transportation and energy source selection using a lexicographic procedure: In this paper, a multi-objective integrated production and energy model for sustainable supply chain design, planning, and energy source selection has been proposed. The model considers economic, environmental, and social concerns. The lexicographic procedure was applied to compromise the conflict objectives with different percentages of deviations. It aims to maximize both profit and overall customer service level while minimizing the gas emissions generated from both transportation and production operations.

In addition, the model helps to select the optimal source of energy from three potential sources of energy considering both capital and operating costs, in addition to the selection of the transportation mode (heavy or light trucks) to satisfy customer demand during the planning horizon with six periods of all products. The efficacy of the model has been evaluated using a comprehensive case study in addition to the analysis of several scenarios with various conditions. Six different scenarios have been carried out to

validate the effectiveness of the proposed model and to study the effect of changing objective prioritization and the maximum allowable deviation on the performance of the supply.

Miguel GastónCedillo-Campos, How to measure and monitor the transportation infrastructure contribution to logistics value of supply chains?: When it comes to the competitiveness of companies, and of nations, the key role of the transportation infrastructure to increase logistics value of supply chains is clearly acknowledged. In fact, many comparative indicators that measure countries' competitiveness consider infrastructure of transportation as a key element. Nonetheless, most part of them give more credit either to the infrastructure density (km of roads per km² of territory) or to the amount of resources invested in its development (millions of dollars) than to the its logistics effectiveness and resilience that may bring to the supply chain operations. Based on six indicators: i) Travel time (95 PCTL); ii) Average travel time; iii) Projected travel time; iv) Freight rates; v) Risk of accident; and vi) Carbon footprint, the objective of this paper is twofold. First, to propose a standardized measurement approach of logistics value provided by the transportation infrastructure to supply chains as a unified perspective.

Beatrice Marchi, Technical note on "Inventory management in supply chains with consideration of Logistics, green investment and different carbon emissions policies": This study presents an extension of the model proposed by Huang et al. (2020), which investigated the effects of carbon policies and green technologies on the integrated inventory management of a two-echelon supply chain with consideration of carbon emissions during the processes of production, transportation, and storage. Specifically, since the inventory policy impacts on the economic and environmental performances of the supply chain, this study proposes a mathematical model for the integrated inventory management of the single-vendor single-buyer supply chain under a consignment stock policy. The aim is, thus, to highlight advantages and disadvantages of the consignment stock agreement with respect to the traditional policy based on the model proposed by Hill (1999). To compare the results, the same three carbon emissions policies are considered: i.e., limited total carbon emissions, carbon taxation, and cap-and-trade. The proposed model can assist firms in determining their optimal inventory policy (i.e., agreement, production quantity, delivery quantity, and green investment amount) with an aim of minimizing the supply chain costs under different carbon emissions policies.

Yena Lee, Optimisation frameworks for integrated planning with allocation of transportation resources for industrial gas supply chains: This work addresses the integrated optimisation of production-distribution planning

and allocation of transportation resources for industrial gas supply chains. The production-distribution planning decisions include the production plan, purchasing plan for both a liquefied product and raw material from external suppliers, distribution plan by railcars and trucks, and demand allocation. In contrast, the allocating decisions of transportation resources involve the number of trucks and railcars at each plant, depot, and third-party supplier. First, we propose a mixed-integer nonlinear programming (MINLP) model, and then the MINLP model is reformulated as a mixed-integer linear fractional programming (MILFP) model.

A. Perna, Designing, sizing and economic feasibility of a green hydrogen supply chain for maritime transportation: Green hydrogen plays a strategic role in the decarbonization of the maritime transportation. A step useful to favor the use and the exploitation of the hydrogen is the development of hydrogen supply chains that, by including both the infrastructures and the end users, can simplify the economic issues and the authorization processes. This paper is focused on the designing, sizing and economic feasibility of a sustainable supply chain that consists of a solar-driven electrolysis system that generates hydrogen for powering a fuel cell-based propulsion system installed on board a small passenger ferry boat travelling on a short route. The sizing procedure is based on a numerical procedure that aims to find the optimal supply chain configuration, in terms of components' sizes, able to satisfy the hydrogen demand and to sustain the electrical energy requirements by only using the renewable source. Results of this study highlight that a hydrogen production of 128.7 tons/year is produced by using an alkaline electrolysis unit of 1780 kW integrated with a 8.15 MWp photovoltaic power plant.

The produced hydrogen allows satisfying the specific requirements of the ferry boat with a total number of 314 roundtrips per year. From the economic point of view, by valorizing the electricity surplus and the by-product oxygen from the electrolysis process, the estimated profitability index and the discounted payback period are 2.03 and 9 years, respectively, making the investment attractive. The calculated levelized cost of the produced green hydrogen is equal to 5.61 €/kg. These results demonstrate the techno-economic feasibility of the proposed supply chain based on hydrogen technologies that, being already available on the market, can be effectively implemented to support the decarbonization of the maritime sector.

V. CONCLUSION

The purpose of this research is to investigate the research development in supply chain risk management (SCRM), which has shown an increasing global attention in the past. In today's volatile era with businesses more specifically, supply chains becoming increasingly global, the industrial

environment is heavily affected by uncertainty and risk, which can potentially turn into unexpected disruptions. Financial and political turmoil, socio-cultural changes, highly fragmented and demanding behaviour of consumers, rapid development and changeover of products, have seriously modified the economic and industrial environment in which companies act, bringing out new issues related to continuity of the business against potential disruptive events.

Moreover, one of the key factors contributing to disrupting supply chains is the focus on lean supply chains in academia and industry. Zero-inventory and just-in-time movement of goods became the dominant model that increased the sensitivity of supply chains. Little issues quickly become big issues. Outsourcing has also become the dominant model, increasing the forces driving disruptions such as other customers competing for volume and attention, information flow issues, mistrust, win-lose negotiations, financial stress, misalignment of interests and goals. These have increased the likelihood of a disruption exponentially.

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