INFLUENCING FACTORS OF REDUCING EMPTY TRUCKS IN GUANGDONG, CHINA

Xiaolo Lee
Harbin Institute of Technology, China
Email: wanglingqingx@sina.com

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ABSTRACT

The effective transport system is the necessary element for the high business performance and needs the attentions of recent studies and regulators. Therefore, the current article goal is to examine the impact truck sharing system and supply chain perspective on the improve transportation system and reduce empty truck in Guangdong. This study also analyze the mediating impact of improve transportation system among the nexus of truck sharing system, supply chain perspective and reduce empty truck in Guangdong. This study has taken the quantative method of data collection and used the surveys for gathering data and used the smart-PLS for analysis purpose. The findings exposed that truck sharing system and supply chain perspective have positive association with improve transportation system and reduce empty truck in Guangdong. The results also indicated that improve transportation system positive mediates among the nexus of truck sharing system, supply chain perspective and reduce empty truck in Guangdong. This study guided to the regulators in term of developing the policies related to the transportation system that could enhance the business performance.

Introduction

In a socio-economic environment, the construction of transport networks takes place. Although policy and planning for growth tend to rely on capital, human capital has strengthened in recent years. Regardless of physical and human resources relative value, construction cannot take place without interplay as infrastructure cannot stay successful until proper service and maintenance are carried out. Economic growth cannot concurrently take place without an infrastructure foundation. Many transport operations underlined the dynamic interaction between physical and human resource demands, with their highly transactional and service-oriented roles. The transport sector is a significant economic factor and is a common tool for growth because of its intense use of infrastructure (Bakker et al., 2017). This is particularly true in a global economy where economic prospects, including information and communication technology, have become rapidly correlated with people and freight mobility. A relationship between quantity, efficiency, and the extent of economic growth of transport infrastructure is

evident. Extremely densely interconnected transport infrastructure and networks are typically correlated with high growth levels (Mansourianfar & Haghshenas, 2018; Zhankaziev et al., 2018). Although there are number of studies conducted on transportation system in Guangdong (Crainic, Perboli, & Rosano, 2018; Puchongkawarin & Ransikarbum, 2020) but there is less literature available regarding empty trucks and transportation planning. This study will also highlight the importance of transportation system in the country like Guangdong.

The transport of freight and passengers in Guangdong was largely based on the transport of roads. In terms of transport by freight, road, water, and rail, domestic passengers accounted for 82, 15, and 3 percent, respectively, at 74, 21, and 5 percent, respectively (NESDB, 2012a). That is why the road network can conveniently reach anywhere that door-to-door service is offered, while other transport modes are constrained and of poor service quality. Today moreover, all transport infrastructure proposals and policies are designed to encourage rail and water transport to compete with road transport. A mechanism for all agencies of the Ministry of Transport is to be created for investment proposals and development plans in the Thai National Transport Master Plan 2011-2020 (OTP, 2011). The Master Plan sets a vision for sustainable transportation and then priorities, objectives, metrics, and primary metrics of success. Recently, investment plans for transport infrastructure investment 2015-2022 (OTP 2015) have been identified as a master plan (Peraphan & Sittha, 2017).

The National Transport and Traffic Master Plan (2011-2020, OTP, 2011a) was drawn up by the Ministry of Transport in conjunction with the Eleventh National Economic and Social Development Plan. It outlines both the vision and aims of each transport sector in Guangdong and offers an overview strategy. Volume 1 (2007–2011) of NESDB- 2007 and Volume 2 (2012-2017) of NESDB, along with strategic strategies for logistics growth, mentions the development of transport networks to increase logistics network performance across key corridors. Transport by road, water, and air must be strengthened and optimized. The master plan used all departments within the department as a structure to complete their activities in the same direction integrally. The Master Plan sets a vision for sustainable transportation and then priorities, objectives, metrics, and primary metrics of success. The key transport development plan has six objectives: 1- making Guangdong a communications center. Thai transport development plan, 2- have a high quality of service, reliable transit infrastructure and mobility for industrial zones and communities, 3- to improve and enhance passenger and freight transportation security, 4- Encouraging energy conservation and transport with ecological advantages, 5- improve accessibility and expand public transit use, 6- improve mobility in the movement of passengers and freight (Klungboonkrong, Jaensirisak, & Satiennam, 2017; Peraphan & Sittha, 2017).

The overall spending ratio shows that in 2006-2010 the expenditure ratio for rail transport was very modest (18%), relative to 2011-2020. (46 percent). In 2006-2010,

spending on road transport has declined considerably from 77% to 39% in 2011-2020. Transport infrastructure projects in Guangdong are highly dependent on public loans and budgets. During the first master plan phase, 70% of the expenditure comes from government loans and the allocation, but the growth in the share of private sector investment should be decreased. The strategy for improving transportation infrastructure in Guangdong (2015-2022) (OTP, 2015), was recently established by the government with a view to pushing transportation infrastructure growth into effect. The policies are designed to address those challenges: (1) modal transformation from road to alternative modes that provide lowers transportation costs per vehicle, (2) neighboring country connectivity, (3) movement of people and commodities through Canada, and (4) improvement of transport and logistics facilities laws and regulations. These main five sections of Guangdong's transportation sector are (1) rail infrastructure, (2) Guangdong mass-transit system, (3) road infrastructure, (4) water infrastructure, and (5) air infrastructure.

Literature Review

Sharing abilities trend as an intelligent and efficient means of running a system with consistency. Although, it also applies to the truck sharing system which significantly inserts a centralized system to bring feasible modes of transport for various businesses. This ability is not only beneficial for the efficient transport system but also helps businesses of Guangdong to reduce the empty trucks. The evaluation of truck arrivals is connected with the sharing benefits of trucks to eliminate empty trips (Islam, 2018). A centralized system of logistic services provides an easy mode of sharing truck facilities among the businesses to reduce the empty trucks. This facility of empty truck sharing not only fulfills the demands of businesses but also raises the demand and supply of businesses in Guangdong. Products will be faster than ever in the markets by occupying the truck sharing for a reduction in empty trucks. With the shovel system of trucks, bunching effects are stimulated with faster and slower trucks to reduce the empty trucks (Islam, 2018). Problems of transport are growing due to a large number of empty trucks. Therefore, efficient implementation of truck sharing has somehow overcome the issue of prevailing empty trucks. Empty trucks have been a consistent issue in the markets of Guangdong which are eradicated by the strong appointment of a proper track sharing. The sustainability of trucks is grouped with problems of a railroad which ensures the efficiency of empty truck coverage (Chargui et al., 2020). It denotes the resemblance of a truck sharing system which positively depicts the image over the empty trucks rotating on roads. This could cost the companies without any coverage of cost and will be beneficial after the implementation of a truck sharing.

H1: Truck sharing significantly impacts the reduce empty trucks

While establishing the perspective of the supply chain in the truck systems, positively help to reduce the empty trucks. The determination of supply chain may vary

upon the goods circumstances which are playing benchmark role toward the empty trucks reduction. It is upon the planning and management of the supply chain of products that could minimize the reduction of empty trucks. The perspective of the supply chain is disrupted due to the propagation of normal and systematic risks related to empty trucks (Scheibe & Blackhurst, 2018). The speedy inclusion of a green supply chain has emerged in the past few years which positively eliminated the dominance of empty trucks. Especially in Guangdong, empty trucks have gained much importance for organizations costing a lot. Therefore, the significant development of the supply chain focus has attained importance over the reduction of empty trucks. It is the flexibility of drivers consistent with the operations of services, supply chain, and manufacturing that counters the ratio of empty trucks (Ivanov, Das, & Choi, 2018). With the collaboration of supply chain focus, the reduction in empty trucks has been significantly erased. There is the dominance of schedules for the efficacious supply chain of products that developed the models of empty trucks in Guangdong. Huge traffic of empty trucks has where created environmental problems also hikes the costs of organizations. Upon the prioritization of some feasible solutions related to the reduction of empty trucks, the decisions making element is important (Rahimdel & Mirzaei, 2020). Special considerations are required to contribute a specific portion toward the conditions that are more related to the dominance of empty trucks. Although, many elements like off-road conditions, payload capacity, the large size of products, and suspension systems are also important toward transportation system.

H2: Supply chain focus significantly influence reduce empty trucks

Trucks with empty material not only costs the companies but also raise high traffic on the roads which are also dangerous to the environment. The capabilities of shared ahead among the logistic companies allow collaborative measures to various businesses with an improved transportation process in Guangdong. These measures help businesses and private consumers to fulfill their needs within a short time. Certain recovery systems are established to reduce the hike in costs of empty trucks and this will also improve the transportation system (Terblanche, Kearney, & Knights, 2018). With the proper system of logistics transport, the companies can decrease their fleets on the road with improved transports. Goods could be easily moved to one place from another with an improved transportation process in Guangdong. This could be efficiency done by the induction of a truck sharing system that impacts the improved transportation process. Resource sharing and product consideration schedule the problems related to truck sharing that help task resources to improve the systems of transportation (Liu et al., 2018). The truck sharing system has provided beneficial measures for the reduction of empty trucks in huge organizations as well as small enterprises. This positive development of the truck sharing has also helped the improved transportation process for competitive markets. Many competitive

organizations of Guangdong have enabled the truck sharing through which the empty trucks have been significantly erased. Effectiveness of transportation system reduces the transportation congestion and also improves the system of transportation with service and operational effectiveness (Suryani et al., 2020). Some factors are influential toward the uncertain elements of the improved transportation process with future and alternative strategies.

H3: Truck sharing significantly impacts the improved transportation process

Although, certain facilities have been explored by the induction of supply chain perspective which hikes the demand for goods. The higher demands have also raised the modes of transportation and hence also increased the traffic on roads. Especially, the Guangdong transport system is improved by the increment in supply chain perspective. External risk factors are evident toward the supply chain focus which enables the improvement toward the transportation system (Lockamy, 2017). With an emerging improvement in the supply chain focus with fast-moving goods, the transportation system has also been improved. This improvement comprises various techniques which have been inducted by the organizations in the form of supply chain dimensions. While classifying the goods of various nature, the trucks and transportation have been designed accordingly. In the creation of values, loops of supply chain management help the fast consumer goods services for the improvement of the transportation system (Mishra, Hopkinson, & Tidridge, 2018). With the establishment of a supply chain focus, the transportation system has been improved for the reduction of congested traffic. By applying the improved transportation process, the impact of the supply chain focus has attained much importance for the organizations of Guangdong. This helped the companies to establish better measures for the management of transportation fleets with an improved transportation system. Demands of transportation planning are increased with the perspective of the supply chain that enhances the transportation system (Lawson, Newman, & Monz, 2017). These are usually based on the crow of visitors and the systems of shuttles convene the supply chain focus with a variety of threshold factors. Driving efforts of unintended demands and planning operated the convenient transportation system.

H4: Supply chain focus significantly influence the improved transportation process

Many intelligent and efficient systems help companies and organizations to manage the discrepancies prevailing in their structures. These discrepancies also define particular gaps which are importantly rectified by the establishment of a truck sharing. Especially, in the Guangdong companies, more transportation system and truck improvement has overcome the elements of reduction in empty trucks. A variety of frameworks has been developed while considering the improvement toward the

transportation system (Fontoura, Ribeiro, & Chaves, 2020). The establishment of an improved transportation process helped the truck sharing more feasible. This development of an improved transportation process in Guangdong also endorsed significant measures for the reduction of empty trucks. The positive mediating role of the improved transportation process is depicted among the truck sharing and reduction of empty trucks. The routes of intercity for trucks have been developed with the consideration of reducing empty truck ratio with implementation and incorporation of GPS. After the implementation of a strong truck sharing \to control the hike in empty trucks on road. The improved transportation process has induced significant channels among both factors which are important for the organizations. There is considering the element of truck appointments which have to hinder the role of empty trucks. Therefore, the positive implementation of an improved transportation process plays a vital role in the truck sharing and reduction of empty trucks. The commencement of foldable containers in an improved transportation system helped companies to reduce the empty trucks on roads and belts (Toledo et al., 2020). With the limitations and strengths, the initiatives of various road projects have hiked the demand for the truck which is major in empty trucks transportation.

H5: Improve transportation process significantly mediate among the relationship between trucks sharing and reduce empty trucks.

The channels of the improved transportation are providing feasible benefits to the supply chain focus as well as also improve the reduction of empty products. Different modes of connectivity and complexity also prevail among the supply chain and empty trucks in Guangdong. These modes are efficiently elaborated by the significant mediating role of an improved transportation process. There is significant resilience of transportation system with the systematic reviews of supply chain focus considering challenges and constraints (Zhang et al., 2018). Through transparent and systematic means, the supply chain focus classified materials accordingly to reduce the empty trucks. This reduction has so far been improved by the efficient induction of an improved transportation process. The role of an improved transportation process in Guangdong has also helped companies to reduce the empty truck fleets on the road. Various collaborative means are developed with the chain of humanitarian supplies by emphasizing the organizational culture (Wan et al., 2018). Transport is an international means of not only traveling but also for the management of the supply chain of goods. These are rendered to the improved transportation process which is efficiently managed from the perspective of the supply chain. The elements of costs, time, and accuracy within specified demand and supply are major elements of the supply chain focus in Guangdong. Empty containers are procured with economic returns and the costs and shortage of products are replaced through an effective supply chain (Adetunji et al.,

2020; Prasanna & Haavisto, 2018). This is dependent on the quantities and the cycles of times that integrate the optimal measures of an improved transportation process.

H6: Improve transportation process significantly mediate among the relationship between supply chains focus and reduce empty trucks.

Methodology

This article examines the impact truck sharing and supply chain focus on the improve transportation process and reduce empty truck and also analyze the mediating impact of improve transportation process among the nexus of truck sharing, supply chain focus and reduce empty truck in Guangdong. This study has taken the quantitative method of data collection and used the surveys for gathering data. The five point Likert scale has been followed by the surveys that show five for strongly agree to one for strongly disagree. The employees of transportation business are the respondents that are selected based on simple random sampling. A total of 1200 surveys were sent and received only 760 after three weeks that shows about 63.33 percent.

This research has adopted the smart-PLS for analysis purpose because the purpose of the research is hypotheses testing, the sample size is large and complex framework has been used (Hair Jr, Babin, & Krey, 2017). This research has taken two independent variables such as truck sharing (TSH) with six items and supply chain focus (SCF) with seven items. In addition, the current article is taken improve transportation process (ITP) with seven items and reduce empty truck (RET) is taken as the dependent variable with five items.

Findings

The results have shown the convergent validity that show the relation among the items. The figures has shown that AVE and loadings are not smaller than 0.50 and Alpha and CR are not lower than 0.70. These values have been indicated that high correlation among items. These values are shown in Table 1.

Table 1: Convergent Validity

Constructs	Items	Loadings	Alpha	CR	AVE
Improve Transportation Process	ITP1	0.770	0.890	0.912	0.565
	ITP2	0.784			
	ITP3	0.802			
	ITP4	0.760			
	ITP5	0.702			
	ITP6	0.742			
	ITP7	0.728			
Reduce Empty Trucks	RET2	0.796	0.849	0.898	0.689
	RET3	0.837			
	RET4	0.850			

	RET5	0.835			
Supply Chain Focus	SCF1	0.767	0.880	0.908	0.587
	SCF2	0.813			
	SCF3	0.779			
	SCF4	0.814			
	SCF6	0.781			
	SCF7	0.793			
Truck Sharing	TSH1	0.803	0.813	0.853	0.540
	TSH3	0.727			
	TSH4	0.831			
	TSH5	0.629			
	TSH6	0.663			

The results have also shown the discriminant validity that show the relation among the variables. This study has used the cross-loadings and Fornell Larcker to test the variable relationships. The figures has shown that the values that exposed the nexus with variable itself are larger than the values that show the relations with other variables. These values have been indicated that low correlation among variables. These values are shown in Table 2 and Table 3.

Table 2: Fornell Larcker

	ITP	**RET**	**SCF**	**TSH**
ITP	0.751			
RET	0.628	0.830		
SCF	0.594	0.611	0.766	
TSH	0.440	0.448	0.506	0.735

Table 3: Cross-loadings

	ITP	**RET**	**SCF**	**TSH**
ITP1	**0.770**	0.440	0.419	0.367
ITP2	**0.784**	0.563	0.462	0.374
ITP3	**0.802**	0.478	0.425	0.412
ITP4	**0.760**	0.473	0.441	0.440
ITP5	**0.702**	0.472	0.401	0.300
ITP6	**0.742**	0.449	0.506	0.241
ITP7	**0.728**	0.416	0.455	0.251
RET2	0.523	**0.796**	0.469	0.351
RET3	0.524	**0.837**	0.500	0.398
RET4	0.518	**0.850**	0.533	0.362
RET5	0.518	**0.835**	0.527	0.377
SCF1	0.406	0.432	**0.767**	0.296
SCF2	0.446	0.486	**0.813**	0.325
SCF3	0.408	0.515	**0.779**	0.311
SCF4	0.549	0.503	**0.814**	0.402
SCF6	0.448	0.420	**0.781**	0.389
SCF7	0.431	0.471	**0.793**	0.326

TSH1	0.410	0.396	0.458	**0.803**
TSH3	0.200	0.204	0.286	**0.727**
TSH4	0.468	0.448	0.500	**0.831**
TSH5	0.162	0.216	0.201	**0.629**
TSH6	0.178	0.242	0.249	**0.663**

This study has also used the Heterotrait Monotrait (HTMT) ratio to test the variable relationships. The figures has shown that the values of HTMT are less than 0.85. These values have been indicated that low correlation among variables. These values are shown in Table 4.

Table 4: Heterotrait Monotrait Ratio

	ITP	**RET**	**SCF**	**TSH**
ITP				
RET	0.720			
SCF	0.669	0.705		
TSH	0.438	0.479	0.530	

This study has also shown the relations among the variables and the findings exposed that truck sharing system and supply chain perspective have positive association with reduce empty truck in Guangdong and accept H1and H2. The findings also exposed that truck sharing system and supply chain perspective have positive association with improve transportation system in Guangdong and accept H3 and H4. The results also indicated that improve transportation system positive mediates among the nexus of truck sharing system, supply chain perspective and reduce empty truck in Guangdong and accept H5 and H6. These relations have been mentioned in Table 5.

Table 5: Path analysis

Relationships	**Beta**	**S.D.**	**T Statistics**	**P Values**	**L.L.**	**U.L.**
ITP -> RET	0.384	0.037	10.484	0.000	0.317	0.460
SCF -> ITP	0.500	0.033	15.203	0.000	0.435	0.560
SCF -> RET	0.325	0.043	7.486	0.000	0.232	0.402
TSH -> ITP	0.187	0.035	5.270	0.000	0.118	0.256
TSH -> RET	0.115	0.031	3.751	0.000	0.053	0.174
SCF -> ITP -> RET	0.192	0.024	8.104	0.000	0.150	0.241
TSH -> ITP ->RET	0.072	0.015	4.682	0.000	0.044	0.105

Discussions and Implications

The study results have revealed that the truck sharing has a positive impact on the reduction of empty trucks. The study examines that the number of trucks that are excessive or are not currently underuse can be reduced with the development of truck sharing. These results are in line with the past study of Islam (2018), which shows that the truck sharing allows the sharing of vehicles among the countrymen on rent to serve a group of persons or individuals. The development of this system has brought a

dramatic decrease in the number of trucks which are standing empty without any use. These results are also in with the past study of Schulte et al. (2017), which states that some enterprises or individuals use trucks or other vehicles for transport purposes at some specific time in a day. Afterward, these trucks or other vehicles remain empty and useless. Under the truck sharing, these vehicles can be provided for rent for personal use or for some commercial purpose. This system minimizes the number of empty trucks in the country. The study results have also indicated that the integration of supply chain focus into the transportation industry has a positive association with the reduction of empty trucks. The upstream and downstream supply chains in the transportation industry increase mobility of logistics, material, and other resources across the chain node. This increases the use of trucks or other vehicles, and thus, the number of empty trucks decreases. These results are in line with the past study of Galanopoulos, Barletta, and Zondervan (2018), which analyzes the contribution of the introduction of the supply chain in the transportation industry in the developing economy of Germany.

This study concludes that the supply chain in the transportation industry reduces the number of empty or free trucks as the supply chain motivates mobility of logistics across the concerns in the chain. In a chain, the trucks or other vehicles can be acquired instantly at the time of need, and the enterprises do not have to face issues raised by the excessive number of empty vehicles. These results are also in line with the past study of Abdulrazik et al. (2017). This study compares the situation in the transportation industry both in the case of the supply chain and without the supply chain. This study states that as the supply chain builds a network of all individuals, enterprises, activities, and resources, there is more mobility and more need for vehicles which brings a reduction in the number of excessive or empty trucks and other vehicles. Thus, the supply chain enhances the use of transports and decreases the number of empty vehicles. The study results have shown that the truck sharing has a positive impact on the improvement in the transportation system. The study implies that the development of truck sharing system in an economy brings improvement in the overall transportation system as on one side it increases the use for different types of vehicles, and on the other hand, it facilitates the enterprises which deal in the production and trade of transports. These results are in line with the recent study of Wang et al. (2018), which suggests that the truck sharing system facilitates the transportation enterprises in acquiring material, resources, and technology that enable them to produce the transport equipment and logistics.

The truck sharing is also helpful to the transportation system in mobilizing the products and services. These results are also in line with the literary work out of Kuklina et al. (2020). This workout shows the significance of the introduction and implementation of truck sharing in the overall transportation system. This workout suggests that as under the truck sharing, the transport vehicles can be leased or granted on rent for a specific period of time, which promotes transportation business. Now

many transportation entities buy a number of vehicles and then give them on rent to individuals for personal use or business enterprises for commercial use. Moreover, the study results have indicated that the supply chain focus has a positive association with the improvement in the overall transportation system. These results are supported by the past study of Sim (2017), which shows that like any economic industry, the integration of individuals, enterprises, resources, technology, and processes within a chain improves the performance of enterprises in the transportation industry. The supply chain facilitates the movement of information and other technology which are used in the transportation enterprises in their operations and marketing. The study results have also indicated that the improvement in the transportation system plays a mediating role between the truck sharing and the reduction of empty trucks. These results are in line with the past study of Holeczek (2019), which indicates that the development in the truck sharing brings improvement in the overall transportation system as it creates stimulation in the transportation activities. The improvement in the overall transportation system reduces the number of empty trucks. Moreover, the results have shown that the improvement in the transportation system plays a mediating role between the supply chain focus and the reduction of empty trucks. These results are following the past study of Obara (2019), which shows that the overall transportation system is improved by the integration of transportation stakeholders within a supply chain, and it further reduces the number of empty trucks.

Both the theoretical and empirical implications are made by the current study. The study makes a significant contribution to the economic-based literature. This study gives a detailed description of the contribution of transportation planning factors like truck sharing system and supply chain focus to the reduction of the number of empty trucks. Moreover, this study throws light on the influences of the truck sharing and supply chain focus on the improvement in the overall transportation system. Before the conduct of this study, little attention has been given to the mediating influences of improvement in the transportation system between the truck sharing and supply chain focus and the reduction of the number of empty trucks. This study is one of the initial attempts to introduce the improvement in the transportation system as a mediator between the aforementioned factors and the reduction of the number of empty trucks. This study guided to the regulators in term of developing the policies related to the transportation system that could enhance the business performance. The current study also has a great practical significance to the economists in the emerging economies as it provides guidance on how to reduce the excessive number of trucks that are not underused. This study suggests that the number of empty trucks can be reduced with the developed truck sharing system, the implication of supply chain focus, and improvement in the transportation system.

Conclusion and Limitations

The study investigates the reduction of empty trucks on account of the development of transportation planning system in the economy of Guangdong. In this regard, the study throws light on the truck sharing, supply chain focus, and the improvement in the transportation process and checks their influences on the reduction of empty trucks. This study implies that the improvement in the truck sharing reduces the number of empty trucks. The truck sharing allows the sharing of vehicles among the users on rent to serve either a group of persons or individuals. The development of this system brings a significant decrease in the number of trucks which are standing empty without any use. Similarly, the implication of supply chain focus in the transportation industry increases the use of transport vehicles and thus reduces the number of empty trucks. The study also implies that the truck sharing leads to the improvement in the overall transportation process as on one side it increases the use for different types of vehicles, and on the other hand, it facilitates the enterprises which deal in the production and trade of transports. The study implies that the supply chain facilitates the movement of information and other technology which are used in the transportation enterprises in their operations and marketing. Thus, the supply chain focus improves the transportation process. Moreover, the study states that the transportation process, which is improved by the truck sharing, and supply chain focus, reduces the empty trucks.

The current study addresses a minimal number of transportation planning factors like truck sharing, supply chain focus, and improvement in the transportation process as the measures to be taken to reduce the strength of the empty truck. Economic conditions and many social factors also affect the number of empty trucks in the economy, and all these factors are left by this study unaddressed. Thus, the current study is not comprehensive and less reliable. To produce a more comprehensive and more reliable study, the authors in the future must also investigate the influences of economic conditions and social factors on the number of empty trucks. Moreover, here in this study author has used the improvement in the transportation process as a mediator between truck sharing, supply chain focus, and the number of empty trucks. But, the improvement in the transportation process must be used by future authors as a moderator between the aforementioned factors and the number of empty trucks.

References

Abdulrazik, A., Elsholkami, M., Elkamel, A., & Simon, L. (2017). Multi-products productions from Malaysian oil palm empty fruit bunch (EFB): Analyzing economic potentials from the optimal biomass supply chain. *Journal of cleaner production, 168*, 131-148. doi: https://doi.org/10.1016/j.ejor.2019.02.025

Adetunji, O., Yadavalli, S., AlRikabi, R., & Makoena, S. (2020). Economic Return Quantity Model for a Multi-type Empty Container Management with Possible

Storage Constraint and Shared Cost of Shipping. *American Journal of Mathematical and Management Sciences, 39*(4), 345-361. doi: 10.1080/01966324.2020.1769516

Bakker, S., Dematera Contreras, K., Kappiantari, M., Tuan, N. A., Guillen, M. D., Gunthawong, G., . . . Van Maarseveen, M. (2017). Low-Carbon Transport Policy in Four ASEAN Countries: Developments in Indonesia, the Philippines, Thailand and Vietnam. *Sustainability, 9*(7), 1-10. doi: 10.3390/su9071217

Chargui, T., Bekrar, A., Reghioui, M., & Trentesaux, D. (2020). Proposal of a multi-agent model for the sustainable truck scheduling and containers grouping problem in a Road-Rail physical internet hub. *International Journal of Production Research, 58*(18), 5477-5501. doi: 10.1080/00207543.2019.1660825

Crainic, T. G., Perboli, G., & Rosano, M. (2018). Simulation of intermodal freight transportation systems: a taxonomy. *European journal of operational research, 270*(2), 401-418. doi: https://doi.org/10.1016/j.ejor.2017.11.061

Fontoura, W. B., Ribeiro, G. M., & Chaves, G. D. L. D. (2020). A framework for evaluating the dynamic impacts of the Brazilian Urban Mobility Policy for transportation socioeconomic systems: A case study in Rio de Janeiro. *Journal of Simulation, 14*(4), 316-331. doi: 10.1080/17477778.2019.1701392

Galanopoulos, C., Barletta, D., & Zondervan, E. (2018). A decision support platform for a bio-based supply chain: Application to the region of Lower Saxony and Bremen (Germany). *Computers & Chemical Engineering, 115*, 233-242. doi: https://doi.org/10.1016/j.compchemeng.2018.03.024

Hair Jr, J. F., Babin, B. J., & Krey, N. (2017). Covariance-based structural equation modeling in the Journal of Advertising: Review and recommendations. *Journal of Advertising, 46*(1), 163-177. doi: https://doi.org/10.1080/00913367.2017.1281777

Holeczek, N. (2019). Hazardous materials truck transportation problems: A classification and state of the art literature review. *Transportation research part D: transport and environment, 69*, 305-328. doi: https://doi.org/10.1016/j.trd.2019.02.010

Islam, S. (2018). Simulation of truck arrival process at a seaport: evaluating truck-sharing benefits for empty trips reduction. *International Journal of Logistics Research and Applications, 21*(1), 94-112. doi: https://doi.org/10.1080/13675567.2017.1353067

Ivanov, D., Das, A., & Choi, T.-M. (2018). New flexibility drivers for manufacturing, supply chain and service operations. *International Journal of Production Research, 56*(10), 3359-3368. doi: 10.1080/00207543.2018.1457813

Klungboonkrong, P., Jaensirisak, S., & Satiennam, T. (2017). Potential performance of urban land use and transport strategies in reducing greenhouse gas emissions:

Khon Kaen case study, Thailand. *International Journal of Sustainable Transportation, 11*(1), 36-48. doi: 10.1080/15568318.2015.1106249

Kuklina, V., Petrov, A. N., Krasnoshtanova, N., & Bogdanov, V. (2020). Mobilizing Benefit-Sharing Through Transportation Infrastructure: Informal Roads, Extractive Industries and Benefit-Sharing in the Irkutsk Oil and Gas Region, Russia. *Resources, 9*(3), 21-34. doi: https://doi.org/10.3390/resources9030021

Lawson, S. R., Newman, P., & Monz, C. (2017). A systems-based approach to address unintended consequences of demand-driven transportation planning in national parks and public lands. *International Journal of Sustainable Transportation, 11*(2), 98-108. doi: 10.1080/15568318.2016.1194504

Liu, C., Xiang, X., Zheng, L., & Ma, J. (2018). An integrated model for multi-resource constrained scheduling problem considering multi-product and resource-sharing. *International Journal of Production Research, 56*(19), 6491-6511. doi: 10.1080/00207543.2017.1363428

Lockamy, A. (2017). An examination of external risk factors in Apple Inc.'s supply chain. *Supply Chain Forum: An International Journal, 18*(3), 177-188. doi: 10.1080/16258312.2017.1328252

Mansourianfar, M. H., & Haghshenas, H. (2018). Micro-scale sustainability assessment of infrastructure projects on urban transportation systems: Case study of Azadi district, Isfahan, Iran. *Cities, 72*, 149-159. doi: https://doi.org/10.1016/j.cities.2017.08.012

Mishra, J. L., Hopkinson, P. G., & Tidridge, G. (2018). Value creation from circular economy-led closed loop supply chains: a case study of fast-moving consumer goods. *Production Planning & Control, 29*(6), 509-521. doi: 10.1080/09537287.2018.1449245

Obara, S. y. (2019). Energy and exergy flows of a hydrogen supply chain with truck transportation of ammonia or methyl cyclohexane. *Energy, 174*, 848-860. doi: https://doi.org/10.1016/j.energy.2019.01.103

Peraphan, J., & Sittha, J. (2017). Planning our way ahead: A review of Thailand's transport master plan for urban areas. *Transportation Research Procedia, 25*, 3985-4002. doi: https://doi.org/10.1016/j.trpro.2017.05.242

Prasanna, S. R., & Haavisto, I. (2018). Collaboration in humanitarian supply chains: an organisational culture framework. *International Journal of Production Research, 56*(17), 5611-5625. doi: 10.1080/00207543.2018.1475762

Puchongkawarin, C., & Ransikarbum, K. (2020). An Integrative Decision Support System for Improving Tourism Logistics and Public Transportation in Thailand. *Tourism Planning & Development, 3*, 1-16. doi: 10.1080/21568316.2020.1837229

Rahimdel, M. J., & Mirzaei, M. (2020). Prioritization of practical solutions for the vibrational health risk reduction of mining trucks using fuzzy decision making.

Archives of Environmental & Occupational Health, 75(2), 112-126. doi: 10.1080/19338244.2019.1584085

Scheibe, K. P., & Blackhurst, J. (2018). Supply chain disruption propagation: a systemic risk and normal accident theory perspective. *International Journal of Production Research, 56*(1-2), 43-59. doi: 10.1080/00207543.2017.1355123

Schulte, F., Lalla-Ruiz, E., González-Ramírez, R. G., & Voß, S. (2017). Reducing port-related empty truck emissions: a mathematical approach for truck appointments with collaboration. *Transportation Research Part E: Logistics and Transportation Review, 105*, 195-212. doi: https://doi.org/10.1016/j.tre.2017.03.008

Sim, J. (2017). The influence of new carbon emission abatement goals on the truck-freight transportation sector in South Korea. *Journal of cleaner production, 164*, 153-162. doi: https://doi.org/10.1016/j.jclepro.2017.06.207

Suryani, E., Hendrawan, R. A., Adipraja, P. F. E., Wibisono, A., Widodo, B., & Indraswari, R. (2020). Modelling and simulation of transportation system effectiveness to reduce traffic congestion: a system dynamics framework. *Transportation Planning and Technology, 43*(7), 670-697. doi: 10.1080/03081060.2020.1805543

Terblanche, P. J., Kearney, M. P., & Knights, P. F. (2018). Potential of on-board energy recovery systems to reduce the costs of diesel–electric mine truck haulage. *Mining Technology, 127*(4), 195-208. doi: 10.1080/25726668.2018.1451611

Toledo, T., Atasoy, B., Jing, P., Ding-Mastera, J., Santos, J. O., & Ben-Akiva, M. (2020). Intercity truck route choices incorporating toll road alternatives using enhanced GPS data. *Transportmetrica A: Transport Science, 16*(3), 654-675. doi: 10.1080/23249935.2020.1722284

Wan, C., Yang, Z., Zhang, D., Yan, X., & Fan, S. (2018). Resilience in transportation systems: a systematic review and future directions. *Transport Reviews, 38*(4), 479-498. doi: 10.1080/01441647.2017.1383532

Wang, Y., Peng, S., Xu, C., Assogba, K., Wang, H., Xu, M., & Wang, Y. (2018). Two-echelon logistics delivery and pickup network optimization based on integrated cooperation and transportation fleet sharing. *Expert Systems with Applications, 113*, 44-65. doi: https://doi.org/10.1016/j.eswa.2018.06.037

Zhang, S., Ruan, X., Xia, Y., & Feng, X. (2018). Foldable container in empty container repositioning in intermodal transportation network of Belt and Road Initiative: strengths and limitations. *Maritime Policy & Management, 45*(3), 351-369. doi: 10.1080/03088839.2017.1400699

Zhankaziev, S., Gavrilyuk, M., Morozov, D., & Zabudsky, A. (2018). Scientific and methodological approaches to the development of a feasibility study for intelligent transportation systems. *Transportation Research Procedia, 36*, 841-847. doi: https://doi.org/10.1016/j.trpro.2018.12.068