Contestability between Road and Rail Transport for Dry Cargo in Malawi: Cost and Service Reliability Issues. *The Never Ending Race*

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ABSTRACT

For several years, a modal shift from road to rail transport has been promoted by policymakers and industry experts as it is believed that this move would provide a basis for achieving lower transportation costs. Malawi's main goal is to reduce transportation costs and ensure that transport does not constrain its economy and the achievement of this strategic objective would be by facilitating a modal shift from road to rail transport. While all these efforts are being made, there is still not much to trigger the modal shift. This study therefore, focused on understanding the freight modal split between road and rail and went further to establish the reasons why shippers choose a particular mode of transport for their shipments. A descriptive research design within quantitative methodology was employed. Using a simple random sampling technique, 84 participants were recruited for this study. The finding of the study revealed that 87 percent of shippers use road transport because it provides a shorter shipment delivery window, reliable transport service, and availability. It is therefore recommended that the government should invest to revitalize rail transportation to make it more efficient.

Key Words: Modal Shift, Road, Rail, Theory of Planned Behavior, Malawi

INTRODUCTION

This study is an extract from the principal investigator's thesis from the University of Zambia (UNZA). This is part of a requirement for the award of a degree of Doctor of Philosophy in Supply Chain Management at the university.

Rail freight transportation has been established as a low-freight-cost mode of transport the world over. Studies have been conducted and literature provides evidence that rail transport is comparatively cheaper than road transport (Pinto et al., 2018; Youssef et al., 2016; Zant, 2018; Zhang & Schramm, 2018). Governments and international organizations have also been promoting the use of rail freight transportation (Boehm et al., 2021; Crozet, 2019; Pinto et al., 2018), and despite all these efforts being made, road transport still enjoys a bigger freight share than rail transport (Crozet, 2017, 2019; Kaack et al., 2018) and this has been the case since early 2000 (Chaudhury, 2005). The same phenomenon is also being experienced in Malawi where, regardless of the government efforts in promoting and facilitating a modal shift, there is still not much to trigger this shift *(Malawi National Transport Master Plan, 2017.; Republic of Malawi National Transport Policy, 2015)*. This study therefore sought to establish a modal split between road and rail transport in Malawi and also investigated the reasons why shippers choose a particular mode of transport.

THEORETICAL FRAMEWORK

To connect this study to existing knowledge, a theoretical framework was employed and in this study, the Theory of Planned Behavior was used (Ajzen, 1991).

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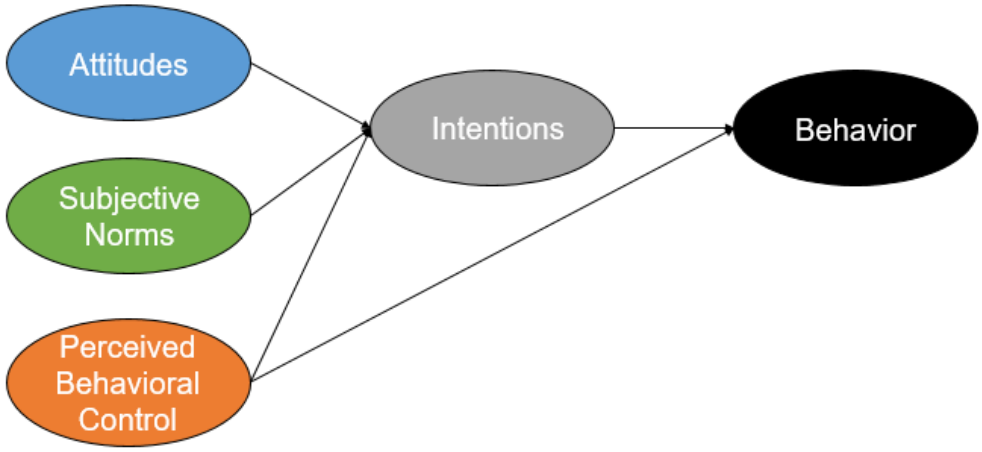
Figure 1: Theory of Planned Behavior (Ajzen, 1991)



The Theory of Planned Behavior postulates that attitude, subjective norm, and perceived behavior control predict intention, and intention along with perceived control predicts actual behavior (Ajzen, 1991). In sum, the theory is used to predict and understand human behavior in the decision-making process. The theory posits that "*ceteris paribus*", individuals are more likely to decide if the results of their decisions are beneficial to them (attitude). The theory further postulates that individuals are more likely to decide if that decision is considered normative (subjective norm) in a society and also if they feel they have the control and resources to make that decision (perceived behavior control).

LITERATURE REVIEW

Transportation plays an important role in determining the international competitiveness of Malawian products (*Malawi National Transport Master Plan*, 2017). This key role that transportation plays has also been described as the lifeblood system of modern society (Engström, 2016), and having a costly transportation system has the potential to increase product prices on the market (Chinecherem et al., 2020; Volpe et al., 2013). Even though efforts are being made to move freight from high-cost road transport to low-cost rail transport, the former continues to occupy a dominant position in the transportation sector (Chaudhury, 2005; Crozet, 2017; Heljedal, 2013). Chaudhury (2005) conducted a study in early 2005 in which the author investigated a modal split between road and rail modes of transport in India and it was established that rail had been losing freight share to road transport.

The benefits of rail transportation to a country's economy have also been appreciated in Europe and there is a promotion of modal shift from road to rail. Development of rail is central to European Union (EU) transportation policy and achieving a modal shift from road to rail would be a great milestone. In 2013, Heljedal (2013) in Sweden conducted a study across the EU block and established that road transportation constituted 74 percent of the total inland tonne-kilometer in the EU during 2009. Moving to recent literature, the EU still faces difficulties in moving freight from road to rail as rail transportation continues to face fierce competition (Crozet, 2017, 2019). This suggests that the proposed policies to move freight from *"trailer to wagon"* are not yielding any results. Efforts are nonetheless being made to deal with this increased imperfect competition.

Malawi's transport system comprises rail, road, air, and inland waterways and over 90 percent of international freight is carried by road transport (*Malawi National Transport Master Plan*, 2017). It is clear from the literature that these freight imbalances between road and rail are general across the world i.e. regardless of the economic status of the country or location. It is also apparent that despite policies

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promoting a modal shift from "*truck to track*", road transport still constitutes a fundamental part of freight transport (Engström, 2016) in Malawi.

Given the fact that policies that are developed and promoting modal shift are not paying dividends, it is imperative to establish shippers' modal choice behaviors. There has been intense research work looking into the factors that influence transport modal choice and several factors have been identified. These factors however are dependent on several other factors which include the nature and value of goods being transported, geographical location, and also economic position of a country. Travel time has been commonly identified in the literature as one of the important factors that shippers consider when selecting a mode of transport (Binsuwadan et al., 2021; Xu & Chen, 2016). A shipper would want to have less travel time and have the goods delivered within the shortest delivery window (Jing et al., 2020; Owuor, 2014). Also commonly identified transport modal choice factors in the literature are transportation costs, transport service reliability, and the availability of a mode of transport (Gnap et al., 2019; Larranaga et al., 2021; Nugroho et al., 2016; Thompson et al., 2022). All these factors have been found to influence the transport mode choice decisions that shippers make whenever they are planning a shipment.

METHODOLOGY

A) Research Paradigm and Philosophical Assumptions

A paradigm is a basic belief system with assumptions about ontology, epistemology, methodology, methods, and also axiology (Saunders et al., 2007). In other words, it is our way of understanding the reality of the world and studying it. Deciding on what type of methodology to use starts with a choice of the research paradigm that informs the study. Particular paradigms may be associated with certain methodologies. The methodology process is therefore guided by philosophical beliefs about the nature of reality (ontology), knowledge (epistemology), and values (axiology). Every researcher has their view of what constitutes truth, knowledge, and value. These views guide our thinking, our beliefs, and our assumptions about society and ourselves, and they frame how we view the world around us. A scientific study is supposed to be based on some underlying philosophical assumptions about what constitutes valid research and which research methods are appropriate for the generation of knowledge in a given study. To conduct and evaluate any research, it is therefore important to know what these assumptions are. As researchers, we have to be able to understand and articulate beliefs about the nature of reality, what can be known about it, and how we go about attaining this knowledge (Kalof et al., 2008).

This study was therefore ontologically guided by the objectivism paradigm which is the belief that social entities have an existence that is independent of human perception or interpretation and that there is a single reality. This ontological position posits that social phenomena and their associated meanings exist objectively, regardless of the subjective views of those who observe or interact with them. Epistemologically, the researcher took a positivist stance where it was believed that knowledge is those statements of belief that can be tested empirically, thus, those with sense experiences. Proponents of this approach also believe that researchers only need the right data-gathering instrument or tools to produce absolute truth for a given inquiry.

B) Research Design

A research design is a systematic procedure for collecting, analyzing, interpreting, and reporting data in a study (Kalof et al., 2008). It constitutes the blueprint or a plan for collecting, measuring, and analyzing data. Social researchers ask two fundamental types of research questions which are *what is going on* and *why is this going on.* The first question is typically addressed by descriptive research design whereas the second question is characteristically answered by explanatory research design. When one is conducting a research

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project, it is important to consider the purpose of the study and what the investigator wants to achieve at the end of that project (Saunders et al., 2007). It is the aim of a study that determines a research design (Creswell, 2013). The purpose of this study was to describe the contestability between road and rail transport and also describe the factors that shippers consider when selecting transport modes. It is for this reason that this study utilized a descriptive research design. Descriptive research design which is also known as statistical research describes the phenomena as they exist. This design was ideal in this study because of its ability to portray accurately the nature of competition between road and rail freight transportation in Malawi.

C) Study Site

Describing a study site is important in any research because it contextualizes the whole study. This study was conducted in Blantyre City, Malawi, from January to August 2023. Blantyre city was an ideal study area because it is a commercial city of Malawi, with a large number of industrial areas where goods are manufactured and exported. The study site was also ideal because, unlike other cities in Malawi, Blantyre City has more international shipping options namely road, rail, and air. The city is also close to the major international shipment seaports viz. Nacala, Beira and Durban.

D) Sample Size

To determine the sample size of this study, a formula was used and it was considered the best method because the formula takes into account the levels of precision, confidence, and variability. The formula is also scientific and easy to use in cases of large populations. It is presented as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where n= sample size required

N= number of people in a population

e= allowable error in percentage

To calculate the sample size from 141 commodity exporting firms in Blantyre, the study specified a 5 percent error as shown in the equation below:

$N = 141/ (1 + 141 (0.05^2))$ ..... 104 (Yamane, 1970).

E) Sampling Technique

Cognizant of the fact that it was not practical to include all cases of a population in a study, samples were used to make inferences about the population. To draw valid conclusions from the results, a researcher carefully decided how to select a sample that was representative of the population. A simple random sampling technique was used in this research to give each sampling unit of a population an equal chance of being included in the sample. The method allowed a researcher to generalize the population without any biases. To select a simple random sample, the investigator used a sampling frame, which was a list of all the units in the population. In this study, a list of exporting firms registered by the Malawi Export Promotion Council in 2022 was a sample frame from which a study sample was drawn.

F) Data Collection

In this study, only primary data were considered and a questionnaire was used to collect data from dry commodity shippers in Blantyre City, Malawi. The study targeted dry shippers only because different goods have different shipping requirements and having a mixture of shippers of different goods in one study could

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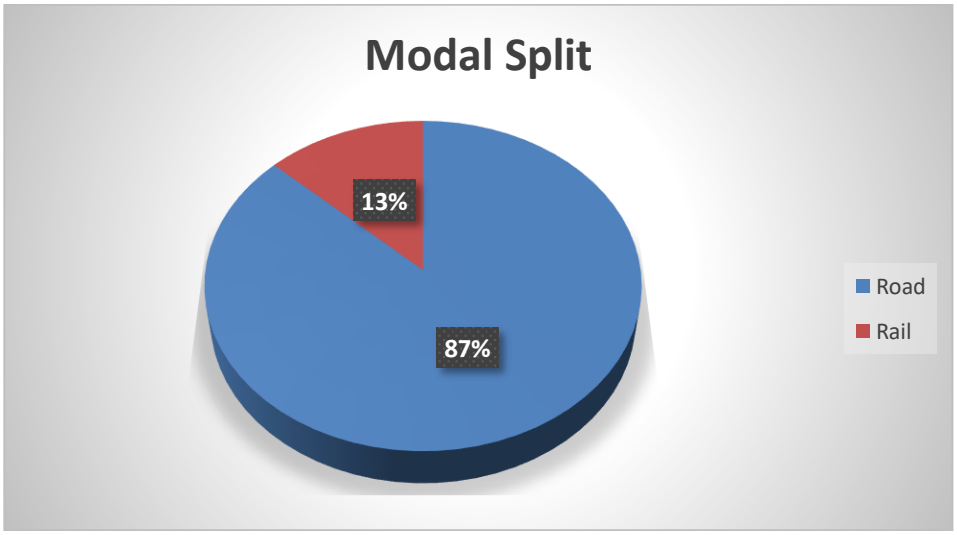
have provided mystifying results. An online closed-ended questionnaire was sent to the study participants through email. The collected data were first organized in Microsoft Excel and then transferred into an SPSS version 20.0 in which descriptive and frequency analyses were performed.

FINDINGS AND DISCUSSION

The study sought to establish the modal split between road and rail transport.

Figure 2: Descriptive Statistics for Transport Modal Split



The results showed that 87 percent of study participants used road transport and only 13 percent used rail transport. This implies that despite rail transport being cheaper, road transport continues attracting commodity shippers and commands a larger freight share. The results of this study reflect those of Heijedal (2013) and also Crozet (2016) who also found that road transport constitutes a larger freight share.

The study also sought to investigate the factors that attract shippers to use a particular mode of transport. Table 1 explains:

Item	N	Minimum	Maximum	Mean	Std. Deviation
Shipment Travel Time	82	1	5	3.28	.652
Freight Cost	82	2	5	3.24	.710
Transport Mode Availability	82	1	5	3.71	.944
Transport Service Reliability	84	2	5	3.90	.919

Table 1: Descriptive Statistics for Transport Modal Choice

Descriptive statistics revealed a mean score of *3.28 (SD=.652)* for shipment travel time, a mean score of *3.24 (SD=.710)* for freight cost, a mean score of *3.71 (SD=.944)* for transport mode availability, and a mean score of *3.90 (SD=.919)* for transport service reliability. These findings show a positive perception among commodity shippers. This therefore suggests that all these factors are important and attract shippers to a particular mode of transport. The results support the work of Owuor (2014), Gnap et al., (2019), and Larranga et al., (2012) who found that shipment travel time, freight costs, transport mode availability, and transport service reliability influence how shippers choose a transport mode.

The study further sought to establish the level of service satisfaction of the mode of transport that the shippers engage in for the transportation of their shipments. Table 2 explains:

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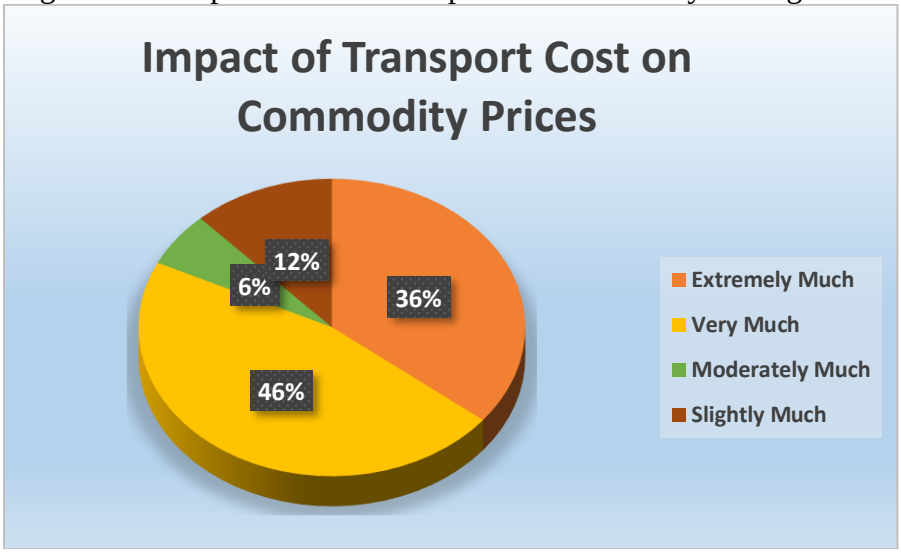
	N	Minimum	Maximum	Mean	Std. Deviation
Satisfaction Level	84	2	3	2.52	.320

Table 2: Descriptive Statistics for Service Satisfaction Level

The descriptive statistics for service satisfaction level showed a mean score of *2.52 (SD=320)* and this suggests that there was a strong positive perception of service satisfaction among shippers. In this regard, commodity shippers found road transport services satisfactory.

The study went further to establish the extent of the impact of transportation costs on commodity prices on the market.

Figure 3: Transportation Costs Impact on Commodity Pricing



The frequency analysis showed that 82 percent of the study respondents had the prices of their goods adversely impacted by transportation costs. The study findings are consistent with those of Chinecherem et al., (2020) and Volpe et al., (2013) where high transportation costs were found in their studies to unfavorably impact commodity pricing on the market.

As the theory of planned behavior postulates, an attitude towards an outcome of a decision has a bearing on the decision that one makes. One would consider whether the outcome of the decision is negative or positive and the theory states that it is more likely for one to make a decision that has a positive or beneficial outcome. According to the theory, a shipper is more likely to choose a transport mode that is cheaper, reliable, available, and the one that provides speedy travel time. These factors of transport mode would be beneficial to the shippers and also to the consignee and this being the case, the shipper is more inclined to select that particular mode of transport providing those values and in this regard, road transport. Similarly, the subjective norm as a factor in the theory of planned behavior has a bearing on the decisions that shippers make when selecting transport modes. Subjective norm, being a belief about whether most people approve or disapprove of the behavior, the stakeholders, which in this regard are shareholders of exporting firms and their customers would put pressure on a shipper to choose a mode of transport that is cheaper, reliable, available and provides a shorter delivery window. Choosing a transportation mode that provides these values would be considered normative behavior. The study findings therefore support the theory used in this study.

CONCLUSION

The study established that high road transportation costs harm the prices of commodities on the market. The

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study also found that regardless of high costs and their adverse impact on commodity pricing, shippers are satisfied with road transport services, and thus, road transport continues enjoying a larger slice of freight in Malawi. Road transport is reliable, available to the shippers, and also provides a shorter delivery window. It is therefore concluded that these latent factors attract shippers to utilize road transport for their consignments despite it being not cost-effective.

RECOMMENDATION

Based on the findings of this study, the researcher provides the following recommendation:

To achieve a transport modal shift, the government should consider revitalizing rail transportation to make it more efficient so that it provides the service values that shippers find in road transportation. Revamping the rail transport may enable it to be reliable, available to the shippers, provide high service frequency, and also be able to provide a shorter shipment delivery window.

REFERENCES

1. Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2),179–211. https://doi.org/10.1016/0749-5978(91)90020-T
2. Binsuwadan, J., De Jong, G., Batley, R., & Wheat, P. (2021). The value of travel time savings in freight transport: a meta-analysis. Transportation. https://doi.org/10.1007/s11116-021-10207-2
3. Boehm, M., Arnz, M., & Winter, J. (2021). The potential of high-speed rail freight in Europe: how is a modal shift from road to rail possible for low-density high-value cargo? European Transport Research Review, 13(1). https://doi.org/10.1186/s12544-020-00453-3
4. Chaudhury, P. D. (2005). Modal split between rail and road modes of transport in India. Vikalpa, 30(1), 17–33. https://doi.org/10.1177/0256090920050103
5. Chinecherem, M., Geraldine, N., & Chidera, K. (2020). Impact of Transportation Cost on Prices of Consumable Commodities in Anambra State. November. www.nauecojournals.com
6. Crozet, Y. (2017). Rail freight development in Europe: How to deal with a doubly imperfect competition? Transportation Research Procedia, 25, 425–442. https://doi.org/10.1016/j.trpro.2017.05.420
7. Crozet, Y. (2019). Introducing Competition in Insights for a Holistic European Rail Sector Regulatory Assessment. International Transport Forum Discussion Papers, 29. www.itf-oecd.org
8. Engström, R. (2016). The Roads' Role in the Freight Transport System. Transportation Research Procedia, 14, 1443–1452. https://doi.org/10.1016/j.trpro.2016.05.217
9. Gnap, J., Poliak, M., & Semanova, S. (2019). The issue of a transport mode choice from the perspective of enterprise logistics. Open Engineering, 9(1), 374–383. https://doi.org/10.1515/eng-2019-0044
10. Heljedal, M. (2013). Factors Influencing the Choice between Road and Multimodal Transportation. In Factors Influencing the Choice between Road and Multimodal Transportation (Issue 1). https://doi.org/10.3384/lic.diva-102169
11. Jing, Y., Xu, W., Guo, S., & Zhang, Y. (2020). Analysis of Choice Behaviors of Railway Shippers for Freight Services Based on a Fuzzy Integrated Choice and Latent Variable Model. IEEE Access, 8, 64399–64410. https://doi.org/10.1109/ACCESS.2020.2984626
12. John W. Creswell's (2013) Research Design 3rd Edition. Qualitative Enquiry and Research Design. Choosing Among the Five Approaches.
13. Kaack, L. H., Vaishnav, P., Morgan, M. G., Azevedo, I. L., & Rai, S. (2018). Decarbonizing intraregional freight systems with a focus on modal shift. Environmental Research Letters, 13(8). https://doi.org/10.1088/1748-9326/aad56c
14. Kalof, L., Dan, A., & Dietz, T. (n.d.). Essentials of Social Research Essentials of Social Research Essentials of Social Research.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue IX September 2023

15. Larranaga, A. M., De Souza, F. L. U., Arellana, J., & Senna, L. A. (2021). Valor do tempo e escolha modal no transporte de carga: estudo de caso de Rio de Janeiro e Rio Grande do Sul. TRANSPORTES, 29(2). https://doi.org/10.14295/transportes.v29i2.2471
16. Malawi National Transport Master Plan. (2017). Ministry of Transport and Public Works
17. Mikwa Owuor, S. odoyo. (2014). Determinants of Choice of Transportation Mode for White Petroleum by Oil Marketing Companies in Kenya. IOSR Journal of Business and Management, 16(2), 135–148. https://doi.org/10.9790/487x-1621135148
18. Ministry of Transport and Public Works. (2015). Republic of Malawi National Transport Policy. April.
19. Nugroho, M. T., Whiteing, A., & de Jong, G. (2016). Port and inland mode choice from the exporters' and forwarders' perspectives: Case study – Java, Indonesia. Research in Transportation Business and Management, 19, 73–82. https://doi.org/10.1016/j.rtbm.2016.03.010
20. Pinto, J. T. de M., Mistage, O., Bilotta, P., & Helmers, E. (2018). Road-rail intermodal freight transport as a strategy for climate change mitigation. Environmental Development, 25(December), 100–110. https://doi.org/10.1016/j.envdev.2017.07.005
21. Saunders, M. N. K., Lewis, P., & Thornhill, A. (2007). Research Methods for Business Students. Financial Times/Prentice Hall. www.pearsoned.co.uk/saunders
22. Thompson, E. A., Abudu, R., & Zheng, S. (2022). Empirical Analysis of Multiple-Criteria Decision-Making (Mcdm) Process for Freight Transportation Mode Selection. Journal of Transportation Technologies, 12(01), 28–41. https://doi.org/10.4236/jtts.2022.121002
23. Volpe, R., Roeger, E., & Leibtag, E. (2013). How Transportation Costs Affect Fresh Fruit and Vegetable Prices. ERR-160, U.S. Department of Agriculture, Economic Research Service, November, 1–38.
24. Xu, Y., & Chen, M. (2016). Improving Just-in-Time Manufacturing Operations by Using Internet of Things Based Solutions. Procedia CIRP, 56, 326–331. https://doi.org/10.1016/j.procir.2016.10.030
25. Youssef, M. Z., Woronowicz, K., Aditya, K., Azeez, N. A., & Williamson, S. S. (2016). Design and development of an efficient multilevel DC/AC traction inverter for railway transportation electrification. IEEE Transactions on Power Electronics, 31(4), 3036–3042. https://doi.org/10.1109/TPEL.2015.2448353
26. Zant, W. (2018). Trains, trade, and transaction costs: How does domestic trade by rail affect market prices of Malawi agricultural commodities? World Bank Economic Review, 32(2), 334–356. https://doi.org/10.1093/wber/lhx011
27. Zhang, X., & Schramm, H.-J. (2018). Eurasian Rail Freight in the One Belt One Road Era. 30th Annual Nofoma Conference:Relevant Logistics and Supply Chain Management Research, February, 769–798. https://www.researchgate.net/publication/328880505