

# Correlates of Transport Mode Choice: *Dry Commodity Movement.* A Case of Malawi.

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## ABSTRACT

Goods from Malawi face a range of challenges in competing on the international market which in part, is as a result of high transportation costs. Despite rail transportation being cheaper than road transportation, Malawi commodity shippers prefer the latter, thus affecting the pricing of the goods on the market. Therefore, the purpose of the study was to investigate the correlates of transport modal choices and the Theory of Planned Behavior (TPB) was used to guide the study. The study employed quantitative approach and descriptive research design in which a questionnaire was used to collect data from a sample of 104 respondents in a population of 141 dry commodity shippers by using simple random probability sampling technique. The key objective of the study was to determine the correlates of transport modal choice in Malawi. The study found that shipment travel time, freight costs, transport mode availability and transport service reliability had a relationship with transport modal choices that shippers made. The study therefore recommends that transport service providers should endeavor take into account these correlates for proper transport planning and management.

**Keywords:** Transport, Cost, Time, Availability, Reliability, Theory of Planned behavior, Malawi

## INTRODUCTION

Transportation plays a prime role in trade facilitation (Rehman et al., 2018). A number of shipping options are available to the commodity shipping community around the world namely road, air, rail, pipeline and water (Aritua, 2019). Although shippers are presented with a wide range of transport options, there are factors that are considered when selecting a mode of transport which include cost, speed, distance, value of commodity, reliability and availability of a transport mode (Brooks et al., 2012; Puteela et al., 2021; Tavasszy et al., 2020). This implies that shippers look for a mode of transport that offers these values when procuring transport services. Malawi transport sector is dominated by road transportation (*Malawi National Transport Master Plan Ministry of Transport and Public Works, 2017*). Table 1 explains the freight demand by modes of transport used in Malawi.

Table1: Freight Demand by Mode in Malawi (In thousands of tonnes).

	2000	2001	2002	2003	2004	2005	2006	2015
Road	711	806	1,876	1,342	1,448	1,470	1,365	2,574
Rail	256	276	280	233	224	171	171	180
Total	967	1,082	2,156	1,575	1,672	1,641	1,536	2,754
% of Road freight share	74	74	87	85	87	90	89	93

Source: Adopted from Malawi National Transport Master Plan (2017)

As shown in Table 1, the rail share has been declining since 2000, principally losing freight share to road. This modal shift is happening while the rail freight cost remains lower than road freight cost (MNTPM, 2017). While efforts are being made to move freight from road to rail and water, shippers still prefer road transport to move their commodities (MNTPM, 2017). Even though a number of policies promoting the use of rail and inland waterway have been proposed, there are still not much to trigger modal shift and reason could be that the factors that determine modal choice of transport are not well understood. Without understanding the requirement of shippers towards transport modes, the efforts that the government is making would be unrewarding.

Malawi economy predominantly operates in primary sector, which is agriculture and mining and also in secondary sector, which is manufacturing and these produce tons of freight requiring transportation. Among the products that the country exports are tobacco, tea, sugar, coffee, cotton and textiles and these goods are principally transported to international markets by road through Beira in Mozambique and Durban in South Africa (Byiers et al., 2020). The transport sector is predominantly operated by a mixture of private local and international companies and these international operators are mainly from South Africa and Mozambique. Literature shows that goods from Malawi faced a range of difficulties in competing on the international market which in part is caused by high transportation costs (Zant, 2018). Despite rail transportation of goods being cheaper than road transportation, Malawi commodity shippers prefer the latter, thus, affecting commodity pricing on the international market (*Malawi National Transport Master Plan Ministry of Transport and Public Works, 2017; Matamba et al., 2023; Vilakazi & Paelo, 2017a; Zant, 2018*). Various previous work speak to the fact that few commodity shippers use rail transportation (Byiers et al., 2020; Matamba et al., 2023a; Zant, 2018). Despite this clear understanding that road transportation is more expensive than rail transportation, commodity shippers in Malawi still prefer the former mode and this poses a problem worth investigating. While the available literature reveals that transportation costs are high in Malawi which in turn adversely impacts the commodity competitiveness on the international markets, there is no clear demonstration of why shippers prefer a costly road transport over the other modes. It is for this reason that a study was required to investigate the correlates of transport modal choices.

### • Purpose of the Study

The purpose of the study was to establish the correlation of transport modal choice in Malawi. The specific objectives were the following:

1. Investigate a correlation between shipment travel time and transport modal choice.
2. Understand an association between transportation costs and transport modal choice.
3. Examine a relationship between transport mode availability and transport modal choice.
4. Analyze the link between transport service reliability and transport modal choice.

The following hypotheses were put forward for testing:

1.  $H_1$ : Shipment travel time has a correlation with transport modal choice
2.  $H_0$ : Transportation cost has no association with transport modal choice
3.  $H_1$ : Transport mode availability has a relationship with transport modal choices
4.  $H_1$ : Transport service reliability has a link with transport modal choice

### • Significance of the study

Correlation research provides insights into complex real-world relationships and this helps researchers, policy makers and practitioners to develop theories and make accurate predictions. This study being correlational, may assist transport service providers and other industry players to improve their decision making in relation to transport planning and also be able to make correct predictions on transport modal

choice factors that correlate with transport mode choices.

### • Study Limitation

The study used online questionnaire to collect data and this required a good internet connection. It was difficult for the respondents to fill and submit the questionnaire in absence of internet connection and those that did not have internet connection failed to participate in the study. Being an online questionnaire, there was a possibility of the presence of sampling bias. Further, transport industry is very dynamic and that cross-sectional study may not be appropriate and it may require longer time to understand issues and thus, longitudinal studies may be needed.

### • Delimitation of the Study

The study was conducted in Blantyre city, Malawi and only targeted manufacturers and dry commodity exporting shippers registered by the Malawi Investment and Trade Centre in the year 2022.

### • Theoretical Framework

The study was guided by the Theory of Planned Behaviour which postulates that human behaviour and decisions are a function of their attitudes towards the outcome of their decisions, the subjective norms and also perceived control behaviour (Ajzen, 1991). Theory of Planned Behaviour assumes that the best prediction of behaviour is given by asking people if they are intending to behave in a certain way (Ajzen,1991). The model further assumes that the consumers make decisions by calculating the costs and benefits of different courses of their actions and choosing the option that maximizes their expected net benefits. It focuses on theoretical constructs concerned with individual motivational factors as determinants of the likelihood of performing a specific behaviour of making a specific choice. This theory is very important because it enables one to understand how individuals behave across different settings, scenarios and situations.

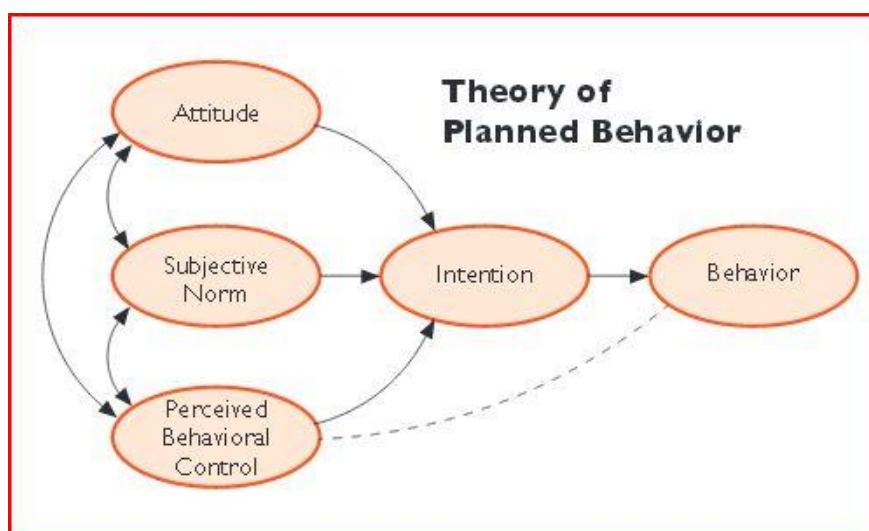


Figure 1: Theory of Planned Behaviour (Ajzen, 1991)

Understanding the motivations behind transport mode choice is of utmost importance for interventions directed towards shipping behavior change. The Theory of Planned Behavior was developed to predict these variables that lead to some specific decisions. Theory of Planned Behaviour maintains that three core components, namely, attitude, subjective norms and perceived behaviour control, together, shape an individual's behavioural intentions. It assumes that human behaviour is a function of these factors as

explained below:

### **Attitude**

The theory postulates that a decision that one makes is dependent on the outcome, thus, whether it is positive or negative, and also depends on the benefits that would be gained as a result of the decision made. It is therefore assumed that it is more likely that the intention to use a mode of transport be higher if that mode is beneficial to the decision maker. Lower transportation costs and reliable transport service are more likely to be correlated with the transport mode that offers that benefit. Thus, one would choose a mode of transport that is lower in cost and also reliable in its services.

### **Subjective norm**

The subjective norm is a person's perception that most people who are important to him or her think he or she should or should not perform the behavior in question (Ajzen, 1991). The subjective norm results in perceived social or peer pressure where the person thinks about what other people expect him or her to do, how they are expected to behave and also whether they would be ridiculed should they make a particular decision. All these shape one's decisions or intentions. The subjective norm is therefore the reference of a perceived expectations multiplied by the motivation of this reference. It is therefore important to notice that the person performing the behaviour decides which referent persons are of importance to him or her. In this study, consignees and shareholders of manufacturing and exporting firms were taken as the referent persons and these were expected to have the influence on the transport modal choice a shipper makes. Thus, these shareholders or consignees would want their goods to be transported with less travel time, at a lower transportation costs in a mode of transport that is available and reliable.

### **Perceived behaviour control**

Control beliefs produce a behaviour control by impacting performance of the behaviour (Ajzen, 1991). This requires whether one has the knowledge to make the decision and whether they have the necessary tools available to them to act. Perceived behaviour control, also known as self-efficacy is an estimate of the skills needed for expressing the behaviour and possibility to overcome barriers. Perceived behaviour control varies across situations and actions, which results in a person having different perceptions of behaviour control depending on the particular situation. It involves the perception of the individual's own ability to perform.

Choice of transport mode is largely a reasoned decision and that this decision can be affected by interventions that produce change in attitudes, subjective norms, and perceptions of behavioral control. It can therefore be concluded that the transport mode choice correlates are influenced by the attitude of the shippers, subjective norms of the shipping community and also the ability of a shipper to make a transport mode choice which is a perceived behavior control.

### **Conceptual framework**

A conceptual framework is a general structure which a researcher believes will best explain the natural progression of a phenomenon to be studied. Unlike a theoretical framework which is based on an existing theory (Grant & Osanloo, 2014), a conceptual framework is so specific to the study variables under investigation. The goal of a conceptual framework is to categorize and describe the concepts or variables under study and show their relationships among them. Simply put, a conceptual framework explains the relationship between the independent variables and dependent variable. So, adapting Theory of Planned Behaviour which is the theory that informed this research, the following conceptual framework guided this study:

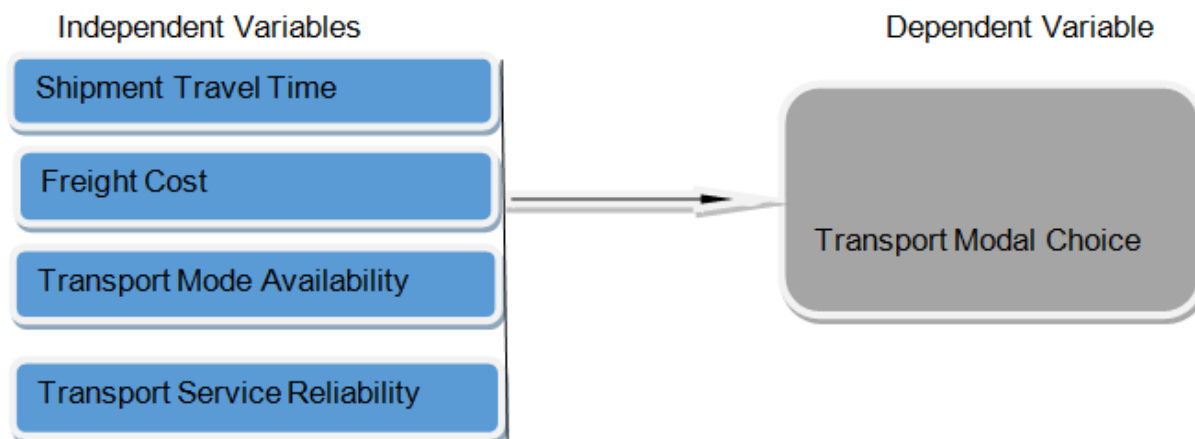


Figure 2: Conceptual Framework

## REVIEW OF RELATED LITERATURE

### Theory of Transport

Transportation is the movement of goods and persons from place to place using various means by which such movement is accomplished. There are four major modes of transport in Malawi namely road, rail, air and water (Matemba et al., 2023a). These modes provide a means to connect manufacturers and customers nationally or internationally (Mironova et al., 2022).

### Transport Influence on a Country's Economy

Transport has been one of the driving forces in the economic development of a country and good transport system spurs trade (Diesendorf, 2002; Rehman et al., 2018). Previous studies have identified a strong relationship between an efficient transport system and a country's economic growth (Alejandro Cardenete & López-Cabaco, 2018; Koźlak, 2017; Mironova et al., 2022; Ravshanov, 2022; Rehman et al., 2018; Vickerman, 2018). The link between transport and economic growth has been debated over the years because of lack of a generally clear relationship that can be used universally (Felicia et al., 2016). However, there has been a relationship between transport infrastructure investments and economic growth (Abayomi et al., 2018; Zhang & Cheng, 2023). With the coming of globalization, transportation has played an important role of trade facilitation as it promotes increased opportunities to participate in international trade (Sénquiz-Díaz, 2021).

### Shipment Travel Time

Time is a valuable and scarce resource and it is for this reason that commodity shippers pay more attention to shipment travel time. Reduced travel time compresses supply lead-time, making a firm more responsive to its customers (Xu & Chen, 2016). Owuor, (2014) conducted a study in Kenya in which the author established that time was an important factor for commodity shippers. Similar studies showed that shipment travel time was an important transport modal choice factor (Jing et al., 2020; Li et al., (2020). The findings of their studies supported the findings by Owuor (2014) that travel time was an important transport modal choice factor. The choice of transport mode decision has been found to be affected by the travel time that mode of transport provides (Konstantinus & Zuidgeest, 2019)

While efforts are being made to reduce shipment travel time, customs clearance processes pose a challenge to this determination. All international trade transactions are processed by customs and as such, slow

shipment movement and extending travel time in the process (Bernacchi & Torello, 2019; Erceg, 2013; Peterson, 2017).

### **Transport Cost**

Transportation cost is the freight charge that shippers pay to a transport service provider for the transportation of their shipments. Driven by the rapid globalization which demands freight movements, freight transportation has become a major source of external costs of transport (Tavasszy et al., 2020). A large and growing body of literature has discussed the factors that influence choices that shippers make when selecting transport mode (Gnap et al., 2019; Grosso, 2011; Larranaga et al., 2021). Grosso (2011) published a paper in which the author examined the factors that influenced transport mode choices, employing generalized cost approach in their methodology and established that shippers place transportation cost as the ranking factor. Other scholars used Multi-Criteria Decision Analysis (MCDA) and examined the importance of freight cost in mode choice and concluded that cost was an important factor (Larranaga et al., 2021; Li et al., 2020; Matemba et al., 2023b).

Transportation costs have also been found to have a relationship with transport modal choices that shippers make when shipping out their goods (Konstantinus & Zuidgeest, 2019). Same relationship has been established in Malawi (Lall et al., 2009; Vilakazi & Paelo, 2017b). Commodity shippers would want to have their goods shipped at a low cost and that has an influence on their decision when procuring transport services.

### **Value of Transport Mode Availability**

Transport availability refers to the diverse or variety of mobility and accessibility options presented to shippers or travellers in a particular situation and this include various modes, services and destination (Litman, 2023). A transport system must be diverse in order to serve diverse demands of customers shipping different types of goods requiring different shipping demands. Availability of transport is vital and is one of the most important outcomes of transportation system and has been identified as one of the important factors which shippers consider when making transport modal choices (Eliasson et al., 2020; Saif et al., 2019). A mode of transport may provide competitive prices, safety and speed, but if its availability and accessibility becomes a challenge, shippers would prefer alternative modes of transport (Cascetta et al., 2020). Transport availability allows shippers to flexibly transport goods to the customers (Wee, 2021).

### **The value of Service Reliability**

Reliability of a service depends on customer satisfaction level with reference to the expected service to perceived service (Kumar & Reddy, 2019), and a service is said to be of good quality based on its assessment of how well a delivered service conforms to the client's expectations (Ramya, 2019). Service reliability is one of the vital success factors in a business for it to sustain, survive and succeed and has also been widely valued in transport industry (Benezech & Coulombel, 2013; List et al., 2015; Satish Kumar & Uma Maheswara Reddy, 2019; Susilowati & Yasri, 2019). Service reliability has been identified as one of the major factors for customer satisfaction (Corman et al., 2018). Satisfied customers are likely to become loyal to a service provider and more likely to provide more business (Lieropa & Ahmed El-Geneidya, 2016).

Thompson et al., (2022) conducted a study in Ghana in which a population of study was freight forwarders and consignees and the results showed that reliability was one of the factors considered when selecting a mode of transport. In their study, however, freight forwarders were firms who also owned trucks to move goods. Including them in the study as participants would have compromised the reliability of the collected data because being owners of trucks, they were technically competitors of the other modes of transport and their responses in the study would be favourably skewed towards road transportation. In this study, only dry commodity manufacturing and exporting firms were recruited into the study.

## RESEARCH METHODOLOGY

### Research Paradigms and Philosophical Assumptions

The study used quantitative methodology and was ontologically guided by the objectivism paradigm which postulates that hypothesis developed from existing theories can be tested by measuring observable social realities. In this philosophical assumptions, the research took an etic approach and believed that there is a single reality. Epistemologically, the study took positivism stance in which the researcher believed that knowledge is those statements of belief that can be tested empirically, thus, those with sense experiences. Proponents of this approach believed that researchers only need the right data gathering instruments or tools to produce absolute truth for a given inquiry. Positivism and objectivism stances were taken in this study because there was a need to examine the relationships between the independent variables and the dependent variable and neutrality of the investigator was vital.

### Research Design

The study used descriptive correlational design and no attempt was made to assess cause and effect of the variables. Descriptive correlational research, which is a type of research design only tried to explain the relationship between two or more variables (Saunders et al., 2007).

### Target Population

The population of the study was manufacturers and dry commodity export shippers in Blantyre city, Malawi. This was because Blantyre city, unlike other cities in Malawi, has more shipping options which are road, rail, air and it is also closer to the sea. The sampling frame was all manufacturing firms that exports commodities listed by Malawi Investment and Trade Centre (MITC) in the year 2022 and 141 firms were identified as study population. The study participants were office clerks, officers, managers and directors of the manufacturing and exporting firms.

### Description of Sample and Sampling Procedures

The study used Yamane (1970) sample size determination formula in which a sample size of 104 was obtained from the study population of 141. Using simple random probability sampling technique, 104 online questionnaires were sent to the respondents and only 84 participants responded to the questionnaire which gave a response rate of 80.8 percent. The Yamane (1970) formula for sample calculation was ideal because it considers levels of precision, confidence and variability and is presented as:

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

Where n= sample size required

N= number of people in a population

e = allowable error in percentage

### Description of Research Instruments

A structured questionnaire was used to collect data from the commodity shippers. This tool was developed with closed-ended questions of five point Likert-scale type for the purpose of measuring respondents' opinions in which 5 represented "strongly agree" and 1 represented "strongly disagree". The quantitative data were collected in one complete cycle and not on a longitudinal basis.

## Description of the Data Collection Procedure

The researcher obtained ethical clearance from the University of Zambia, Humanities and Social Science Research Ethics Committee (HSSRC) then proceeded to acquire a permission from the manufacturing and exporting firms to conduct the study with their members of staff. The informed consent was sought from the respondents after which, the researcher proceeded to administer the questionnaire to 104 respondents.

## Description of Data Analysis and Presentation Procedures

Correlation analysis was used to examine the relationship between transport mode choice factors and the transport mode choice. The collected data were coded in excel sheet according to the variables under study and transferred into the SPSS version 20.0 which was used to process and organize the data.

## STUDY FINDINGS

The study tested the following hypotheses

1.  $H_1$ : Shipment travel time has a correlation with transport modal choice
2.  $H_0$ : Transportation cost has no association with transport modal choice
3.  $H_1$ : Transport mode availability has a relationship with transport modal choices
4.  $H_1$ : Transport service reliability has a link with transport modal choice

Table 2: Correlates of Transport Modal Choices

		Shipment Travel Time	Freight Cost	Transport Mode Availability	Transport Service Reliability	Modal Choice
<b>Shipment Travel Time</b>	Pearson Correlation	1	.608**	.688**	.648**	.635**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	82	80	80	82	82
<b>Freight Cost</b>	Pearson Correlation	.608**	1	.531**	.391**	.623**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	80	82	80	82	82
<b>Transport Mode Availability</b>	Pearson Correlation	.688**	.531**	1	.701**	.621**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	80	80	82	82	82
<b>Transport Service Reliability</b>	Pearson Correlation	.648**	.391**	.701**	1	.655**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	82	82	82	84	84
<b>Modal Choice</b>	Pearson Correlation	.635**	.623**	.621**	.655**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	82	82	82	84	84

\*\* . Correlation is significant at the 0.01 level (2-tailed).



The presentation of results below are based on Table 2

### **Correlation between Shipment Travel Time and Transport Modal Choice**

Results in Table 2 showed that there was a moderate and significant relationship between shipment travel time and transport mode choice ( $r=.635$ ,  $p<.001$ ) and the results supported the proposed hypothesis and therefore, was accepted.

### **Relationship between Freight Costs and Transport Modal Choice**

Concerning the relationship between freight or transportation cost and transport modal choice, results showed that there was a relationship between transportation cost and transport modal choice ( $r=.623$ ,  $p<.001$ ) and this suggests that the hypothesis that was put forward for testing was rejected.

### **Association of Transport Mode Availability and Transport Modal Choice**

In this correlation, results showed that there was an association between transport mode availability and transport modal choice ( $r=.621$ ,  $p<.001$ ) and the hypothesis was therefore accepted.

### **Relationship between Transport Service Reliability and Transport Modal Choice**

The results showed that reliability of transport mode had a relationship with transport modal choices that shippers make ( $r=.655$ ,  $p<.001$ ) and the hypothesis was accepted.

## **DISCUSSION OF FINDINGS**

Shipment travel time, the study found that there was a correlation between shipment travel time and transport modal choice. This pattern of results is consistent with the findings in studies that were conducted by Xu and Chen (2016), Jing (2020) and Li et al, (2020) in which travel time of a shipment correlated with the modal choice of transport. The findings therefore support the study theory which was the Theory of Planned Behavior which postulates that an attitude towards an outcome of a decision has a bearing on a decision one makes. The theory postulates that the shipper is more likely to choose a transport mode that provides shorter travel time. Shorter travel time would be beneficial to both the customer and the shipper. Similarly, the subjective norm as a factor in the Theory of Planned Behavior has a bearing in the decision that shippers make when selecting transport mode. This being what is customary considered accepted in a society, shippers would feel pressured to choose a mode of transport that provides benefits to all stakeholders.

Freight costs have also been found to have a relationship with transport modal choice. The results reflect those of Tavasszy et al (2020), Gnap et al (2021), Grosso (2011) and Larranga et al (2021) that shippers' choices of transport mode were more correlated with cost of transport. The study results are consistent with the position of the Theory of Planned Behavior in that an attitude towards an outcome of a decision has a bearing on a decision one makes. One would consider that if the outcome of the decision is negative or positive and the theory states that it is more likely for one to make a decision which has a positive or beneficial outcome. According to the theory, a shipper is more likely to choose a transport mode with lower transportation costs. Lower transportation costs would be beneficial to the shipper and also to the consignee and this would motivate a shipper to select a mode of transport offering that benefit. Similarly, subjective norm as a factor in the Theory of Planned Behavior has a bearing in the decisions that shippers make when selecting transport mode. Subjective norm, being a belief about whether most people approve or disapprove of the behavior, stakeholders, which in this regard, are shareholders of manufacturing firms and their

customers would put a pressure on a shipper to choose a mode of transport with lower transportation costs.

Also correlated with transport modal choices that shippers make is the availability of transport mode. The study results provided supporting evidence that transport availability has a relationship with transport modal choices. This implies that shippers are more likely to consider a mode of transport that provides high shipping frequency. This finding broadly support the work of other studies in this area linking freight costs with transport modal choice (Eliasson et al., 2020; Saif et al., 2019). The results therefore support the position of the Theory of Planned Behavior

On the correlation between transport modal choice and transport service reliability, the results established that there was a relationship between transport modal choice and transport service reliability. The results are consistent with studies by Benezech & Coulombel, (2013), Corman et al., (2018), Susilowati & Yasri, (2019). According to the Theory of Planned Behaviour, a shipper is more likely to choose a transport mode which is reliable. Reliable transport mode would be beneficial to the shipper and also the consignee and this being the case, the shipper is more inclined to select that mode of transport which is reliable. Similarly, subjective norm as a factor in the theory of planned behaviour has a bearing in the decisions that shippers make when selecting transport mode. Subjective norm, being a belief about whether most people approve or disapprove of the behaviour, stakeholders, which are shareholders of manufacturing firms and their customers would put a pressure on a shipper to choose a reliable mode of transport. Choosing a transportation mode which is reliable would be considered a normative behaviour.

Although these studies were conducted in different geographical locations, time, different methodology and population, it can therefore be concluded that transport choice correlates are the same. The “holy grail” of science is to generalize results across time and space and these study findings have proven to be true across time and space and therefore, can be generalized to other cities in Malawi.

## **CONCLUSION AND RECOMMENDATION**

### **Conclusion**

The research objective sought to determine the relationship between shipment travel time, freight cost, transport mode availability and transport service reliability with transport modal choice. The results showed that there was a relationship between these factors and the decisions that shippers make when selecting mode of transport for their shipments. It is therefore concluded that the transport modal choice correlates being important in shippers’ decision making, transport service providers should pay much attention to these factors in their service provision. Compromising these transport modal choice factors would scare away commodity shippers.

### **Recommendation**

Based on the findings and conclusion of this study, the following observation and recommendation is made:

1. Since the study has established that there is a positive relationship between shipment travel time, transportation cost, transport mode availability and transport service reliability with the transport mode choices that shippers make, transport service providers should endeavour take into account all these variables in their transport planning and management. This may enhance customer service and satisfaction and, ultimately, grow their businesses.

### **Implications for future practice**

1. This study targeted the manufacturers and shippers of dry cargo only and leaving out those that ship

wet cargo. Further research is needed to establish the factors that correlate transport mode choice in wet cargo transportation.

2. This study being correlation, has only found a relationship between variables. An experimental design is needed to establish cause and effect of the variables.

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