

# Multimodal, intermodal and transport systems integration: More than just the number of transport modes.

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## Abstract

Even though intermodal and multimodal transport systems exist and are in operation worldwide, there seems to be an unclear operational definition and explanation to these two systems. Many urban transportation systems can be described as uni-modal in nature and very dependent on only road transportation. Mode monopoly results in many challenges and also leaves customers or passenger with no other alternative service choice. The purpose of this paper is to find the real operational meaning, advantages, and differences between intermodal and multimodal transport systems.

This paper aims at suggesting ways transport integration can be achieved to benefit passengers, operators and all stakeholders. The paper discusses various known mobility theories and approaches related to transport systems and finally proposes a suitable transport integration framework. Using a mixed-method approach, the researcher interviewed various road and air transport operators, policymakers, experts in the transport industry. Data was collected from a survey conducted at various Accra-Takoradi vehicle terminals, both operators and passengers answered questions along the route, which became the basis for the study to find solutions to the research objectives.

The findings of the research proposed a new integrated transport framework. Also, it revealed that there is the need for a clear policy direction and the involvement of all stakeholders and operator both in the public and private sector to cooperate and coordinate efforts towards successful transport integration.

Keywords: Intermodal, Multimodal, Uni-modal, Mode integration, Collaboration and Competition, Urban transportation.

## 1.0 Introduction

Transport modes share the common goal of fulfilling a derived demand, which is the purpose of supporting the mobility of people or goods (Rodrigue, Comtois, & Slack, 2016). There are various mobility theories and approaches that explain the need to move people and cargo. They form the prime theoretical foundation and basis for the introduction of transport systems. Understanding the essence of transport integration is vital in building a sustainable and robust transport system. Transport integration may be explained as an arrangement where various modes or types of transport services are operationally linked together and cooperate operationally to achieve a seamless, sustainable, connectivity and flow of services to the benefit of customers. Strategies for Public Transport in Cities, (SPUTNIC), explains that integration implies the opportunity to use the entire public or private transport systems in a timely and structured manner across a local or regional area, independent of transport modes, tariffs, fares, ticket systems or schedules (SPUTNIC, 1998).

Transport integration is, therefore, a multi-faceted concept that includes several factors and a multiplicity of definitions (Train, Givoni, & Banister, 2011). Lack of explanation has led, some to dismiss transport integration as an obfuscatory device, meaning a device of bewilderment or confusion difficult to understand (Glaister, 2002). Others have embraced its complexity by describing transport integration as a scalar issue (Potter & Skinner, 2000). Meaning it has a variable

quantity that cannot be resolved into components or it is a directionless magnitude. Many researchers explain transport integration by referring to the rungs of the integration ladder, as explained by (Hall, 2010).

Countries such as Denmark and Switzerland have implemented as part of transport integration, a national integrated ticketing system, which extends across transport modes to various destinations. The UK, Australia and Sweden also use the ticketing system on public transportation in major cities and metropolitan areas in their country. In Africa, the South African government has plans towards moving the country forward to the formation of an integrated transport system (Shankaran & Chaithra, 2018). There is also a white paper, and transport framework with a vision with PIDA<sup>1</sup> and AUC to support African countries integrate their transport network by the year 2063 (EU, European Development Fund and Group, 2016) and (Union, Fund and Group, 2016).

Just like many other countries, the government of Ghana had as part of its national transport vision, an objective to implement an integrated transport system by 2020. This vision has, unfortunately, not taken place. The key policy objective for the transport sector was to establish an efficient and modally complementary and integrated transport network for movement of people and goods” (Kwakye and Fouracre, 1998).

There seems to be some unclear definition and confusing explanation of intermodal and multimodal transport systems (Crainic & Kim, 2007). Available literature seems to erroneously suggest that these two systems are synonyms and could be interchanged. The unfulfilled national policy objective, coupled with the lack of clarity on the concepts of ‘multimodal’ and ‘intermodal’ establishes the relevance of this current paper. This paper explains each of these transport systems, the advantages of each system and the differences between them as they relate to operations, linkages, relationships, transport contractual obligations and documentation. The paper also proposes, by qualitative methods, how an integrated transport system can be implemented. The paper is set out in seven sections, including the introduction. Section 2 reviews the literature on mobility theories and approaches and explains the unclear aspects of intermodal and multimodal transport systems. The third section explains the components and requirements of a successful integrated transport system and reviews transport integration frameworks. Section 4 specifies the materials and methods. Section 5, enumerates the findings and finally, Section 6, brings a conclusion to the paper.

## **2.0 Mobility theories and approaches: A survey of the literature**

Since time immemorial, humanity has learnt to move people and cargo over distances using traditional, non-motorised or semi-motorised forms of transport. Mobility looks at movement and the forces that either drive or constrain it. Mobility paradigms lie “at the centre of constellations of power, the creation of identities and micro-geographies of everyday life” (Creswell, 2011, p.551). Mobility is, therefore, a contemporary paradigm in the social sciences that examines the movement of people and goods as well as the broader social implications of these movements on societies and communities. Mobility theories and approaches emerged from a critique of contradictions in the orientation towards both deterritorialisation in social science and sedentarrism i.e. a type of life style involving very little movement. In other words, people have seen as either static entities tied to specific places or as nomadic, meaning wandering from one place to another.

Many types of mobility theories and approaches have been formulated. Notable types are the that which was categorized by (John Urry, 2000) and (Larsen, Urry, & Axhausen, 2007). They divided mobility into five types being:

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<sup>1</sup> Program Infrastructure Development for Africa (African Union)

1. Mobility of objects, 2. Corporeal mobility, 3. Imaginative mobility, 4. Virtual mobility and finally 5. Communicative mobility.

Sheller and Urry (2006) outlined the six bodies of theories underpinning the mobility paradigm in the social sciences. These include the work done by the original provider of the framework for mobility studies, George Simmel, who in 1959, looked at how connections are established, for meetings and the many ways socialisation takes place among people. Simmel focused on the increased rhythm of urban life, which influences not only its social, economic, and infrastructural formations but also the psychic forms of the urban dweller.

The second body of mobility theory comes from science and technology studies. This theory looks at mobile socio-technical systems that incorporate a hybrid of human and non-human components. These include the automobile, rail or air transport systems that are involved in a complex transport network that affects societies. It was proposed that non-transport information networks may also have unpredictable effects on encouraging or suppressing the physical mobility of people (Pellegrino, 2012) (Rossi, Gastaldi, Carturan, Pellegrino, & Modena, 2012).

The third mobility theory comes “*from the post-modern conception of spatiality, with the substance of places being constantly in motion and subject to constant reassembly and reconfiguration*” (Thrift, 1996, Sheller and Urry, 2006 p. 215)

The fourth body of mobility theory is a “*re-centring of the corporeal<sup>2</sup> body as an effective vehicle through which we sense, place, move, and construct emotional geographies*”. For example, the car is “*experienced through a combination of senses and sensed through multiple registers of motion and emotion*” (Sheller and Urry, 2006, p. 216).

Then the fifth body of mobility theory explains how topologies<sup>3</sup> of social networks relate to how complex sequence, patterns form and also change. Contemporary information communication technology systems and ways of life have often created large but weak social ties across time and space, with social life incorporating few chances of physical meetings and more networked connections, (Sheller and Urry, 2006).

Finally, the last body of mobility theory is the analysis of various complex transportation systems that are “neither in perfect order nor chaotic. “For instance, the rigid spatial coupling, operational timings, and historical bindings of rail contrast with unpredictable environmental conditions and ever-shifting political winds, (Sheller and Urry 2006 pp 215 and 216). These theories lead us into the need to analyse the displacement approaches in three interacting aspects of mobility. These approaches are the spatial, social, and perceptive approaches. The first approach is the Spatial Approach. This approach focuses on different land use and distribution of human activities in space. By this, people need to move around depending on their location and location of activities they wish to perform daily (Muro-Rodríguez, Perez-Jiménez and Gutiérrez-Broncano, 2017).

The secondly is the Social Approach, that refers to individual movements that are exclusively linked to their socio-economic characteristics (Muro-Rodríguez, Perez-Jiménez and Gutiérrez-Broncano, 2017).

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<sup>2</sup> It is something related to the body or something physical or tangible

<sup>3</sup> Refers to geometrical properties and spatial relations unaffected by the continuous changes in form, quantity, shape or size of figures.

Then finally the Perceptive Approach, which refers to the image that is formed or accepted by individuals which vary from person to person or group but lead in many different ways to assessing the same information that influences decision making (Muro-Rodríguez, Perez-Jiménez and Gutiérrez-Broncano, 2017). These theories and approaches are practically demonstrated in the operation of transport systems. Therefore, transport system can be conceptualised as the set of relationships between nodes<sup>4</sup>, of networks and the demand.

Later, Fortunati & Taipale, (2017) proposed alternative types that takes the individual and human body as a point of reference and differentiate between

1. Macro – mobility: (that is the consistent physical displacement of people)
2. Micro –mobility: (being the small-scale displacement of people).
3. Media-mobility: (This being movement that is added to traditionally fixed forms of media) and
4. Disembodied mobility: (That is movement or transformation arranged in an accepted social order.)

It must be however noted the contrary to their seemingly uniqueness and independence in literature, these are very inter-related and not entirely exclusive.

### **3.0 Intermodal and Multimodal Transport Systems**

#### **Intermodal transport system**

There is no clear consensus on the definition in literature on intermodal transportation, despite the growth in intermodal transportation. Intermodality means many things to many people (Crainic & Kim, 2007). Several people and organisations have defined or explained it in different ways. The European Conference of Ministers of Transport (1993) explained intermodal transportation as the *“movement of goods in the same loading unit or vehicle, which uses successive, various modes of transportation (road, rail, and water) without any handling of the goods themselves during transfers between modes”* (European Conference of Ministers of Transport, 1993).

According to the United Nations Economic Commission for Europe, intermodal transportation is “the movement of goods using two or more modes of transport but in the same unit or the same road vehicle, and without stuffing or unloading (Nations United, 2019)”. The United States Department of Transportation (USDOT) also explains intermodal transportation as: *“the use of more than one type of transportation, e.g. transporting a commodity by barge to an intermediate point and by truck to a destination”* (Oudani, El, Alaoui, Boukachour, & Havre, 2014).

Macharis and Bontekoning, (2004) and Ye, Shen and Bergqvist, (2014) also explain intermodal transport as *“the combination of at least two modes of transport in a single transport chain, without a change of container for the goods, with most of the route travelled by rail, inland waterway or ocean-going vessel and with the shortest possible initial and final journeys by road.”* This definition was later revised by Loo and Comtois, to include passenger movements as well. He explained intermodal transport as, *“the transportation of people or load from its origin to its*

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<sup>4</sup> Where movement originates, ends and the transiting points of entry or exit in a transport system. They vary according to the location or geographical scale being considered, ranging from local nodes such as a rail station, or bus terminals to global nodes such as harbours or airport terminals.

*destination by a sequence of at least two transportation modes, the transfer from one mode to the next being performed at an intermodal terminal” (Loo & Comtois, 2016).*

The explanation by the European Conference of Ministers of Transport, 1993 seems to suggest only the movement of goods in the same unit or vehicle, and this erroneously leaves out movement by people or passenger transportation. Also, the definition by Macharis & Bontekoning (2004) erroneously tries to explain intermodal transport as the movement of cargo with various types of transport modes, moving seamlessly on routes, from origin to destination. This definition expresses confusion with the explanation of multimodality transportation systems. Just like many others, this explanation again restricts intermodal to the carriage of only cargo and excludes passengers (people).

The above explanations of intermodal transportation by European Conference of Ministers of Transport (1993), Crainic and Kim, (2007), as well as the United Nations Economic Commission for Europe (Nations United, 2019) all seem to suggest that intermodal transport is a system that relates only to freight (cargo) transportation. However, the author agrees with Loo and Comtois, (2016) and wishes to establish that intermodal transportation relates to either freight haulage or passenger movement for both short or long distances, covering rural and urban areas and also national and international zones.

From all the above, it is clear that the intermodal transport system has no universally agreed definition. Against this backdrop, this present paper operationalises the definition of the intermodal transport system as: The use of two or more similar transport services or modes, for the carriage of either cargo or passengers, that has its operations directly linked together in a sequentially order from one leg or a trip to the other. The distinguishing features are illustrated in Table 1.

#### **Advantages of intermodal transport systems include:**

- Shippers of cargo can choose carriers to take advantage of lower rates for each transport leg or trip. Similarly, in intermodal passenger transportation, passengers select between available services and pay the fares for each trip or leg.
- Cargo transporters may gain flexibility and specialised handling of loading and unloading goods at different ports or destination.
- In terms of cargo transportation, intermodal transportation may benefit from increased security of the products being transported.
- They may also have better access to equipment and can better control capacity and selection of transit schedules.

#### **Multimodal transport system**

Multimodal transport was initially developed mainly because of the need to ensure the continuation of the terrestrial ocean freight. Several governmental agencies and companies have proposed their definitions of multimodal transportation.

The United Nations Economic Commission defines multimodal transport for Europe (UNECE, 2009) as *“the transport of goods by at least two different modes of transport.”* This definition is unfortunately too vague, and it does not differentiate the meaning of the two transport systems. Other authors have simply viewed and explained multimodal transportation to be the same as co-modal transportation. Whereas multimodal transportation is defined by the Commission of the European Communities (CEC, 2006) as *“the use of two or more modes of transportation.”*

Multimodal transportation system is therefore operationalised in this paper as; The use of two or more different transport services or modes operationally combined, with a single contract to transport people or cargo from the point of origin to destination in a coordinated manner.

Therefore, multimodal freight transportation may be explained as the transport operation where despite the use of several different modes, a single provider and a single contract is issued. This operator assumes the entire responsibility of the cargo from origin until it arrives at its destination (MacAndrews,2019).

### **Advantages of multimodal transport systems**

In general, some of the advantages of multimodal transport include:

- It enables a smooth and seamless flow of transport services from the point of origin to destination across various transport modes.
- It ensures the most efficient combination or multiple means of transport while optimizing deadlines.
- It cuts back on inventory costs, therefore keeping the costs of the merchandise under control.
- It results in higher environmental sustainability since multimodal transport reduces the environmental footprint of transportation.
- It results in the reduction of indirect costs of freight transportation and cost related to equipment use and human resources need for operations.
- It contributes to the growth of the industry and economies of scale, especially when it comes to transport negotiations and also the construction and use of better, transport infrastructure and terminals.

Despite the support of environmentalists and cargo transportation experts, multimodality may induce individual costs through the use of modal interfaces, such as transshipments. However, all these costs put together are relatively less expensive as compared to uni-modal or intermodal transportation, and it also makes it a more efficient means of transport. A multimodal transport system integrates different geographical scales from the global to the local and gives accessibility to the global market through the development of transport infrastructure and transport terminal hubs (Muro-Rodríguez, Perez-Jiménez and Gutiérrez-Broncano, 2017).

**Table 1. Differences between intermodal and multimodal transport systems**

<b>DESCRIPTION</b>	<b>INTERMODAL TRANSPORT SYSTEM</b>	<b>MULTIMODAL TRANSPORT SYSTEM</b>	<b>INTEGRATED TRANSPORT SYSTEM</b>
<b>OPERATION OF SYSTEMS</b>	Two or more similar transport modes operationally linked together.	Two or more different modes operationally combined as if one system.	More than two transport modes operationally combined and linking one another from origin to destination
<b>OPERATIONAL LINKAGES AMONGST SERVICES OR MODES</b>	A direct link or connection of services of operators in a similar mode of transport. From one to another sequentially from one leg to the other.	A single service operator assumes all responsibility by coordinating between various service operators or mode operators, from the point of origin to the destination.	A direct link or connection of services where one party or operator assumes the coordinating and is responsible from origin to destination.
<b>KEY OBJECTIVE &amp; RELATIONSHIPS OF THE SYSTEM</b>	The critical relationship or objective of intermodal transportation is cooperation among various modes of transport services.	The critical relationship or objective of multimodal transportation is to ensure coordination of all the transport modes and services	Essential relationship or objective is to ensure both cooperation and coordination of all the transport modes and services.
<b>TRANSPORT AGREEMENTS, CONTRACTS, DOCUMENTATION &amp; POLICY</b>	May have various transport agreements/documents/fares or freight tariffs for each modal trip or sometimes transport service leg.	A single transport document is used for the whole trip from beginning to the end regardless of the number of services, trips or transport modes system engaged	A single transport document or ticket purchased in advance may be used for any available service along the route
<b>FLOW OF TRANSPORT SERVICES / ACTIVITIES</b>	May lack a seamless flow. (To enhance the flow of the service, there is the need to ensure reliability, direct movement, inter-connection of transport services and adequate information flow .)	Operate a seamless flow. (Transport service flow, does not arise out of limitation in structure, but there is a voluntary and natural process to work together as teams)	A smooth flow of services to benefit passengers regardless of the ownership, structure, type of service, terminal connectivity or infrastructure.

Source: Field Research 2018 and extraction from literature

Table 1: Summarizes the differences between intermodal and multimodal transport systems. It adds an explanation and comparison of these two systems with an integrated transport system.

### 3.0. Components and requirements of a successful integrated transport system

There are several prerequisites for the achievement of successful integrated transport. Ferreira, Charles and Tether, (2007) listed three main prerequisites; however, the author adds a fourth that is drafting of integrated transport policy. The prerequisites include:

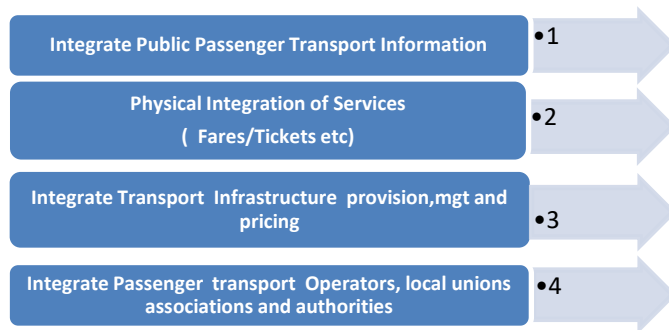
- Drafting an integrated transport policy: which is the main legal framework or document needed to commence the implementation of an integrated system. A clearly expressed and drafted policy should explain the plan, scope, processes, requirements, timelines, and resources needed, responsibilities and roles of all stakeholders and various activities concerning integration.
- Integrated Planning: A significant challenge of the task is to get all those responsible for planning and delivering of transport networks, to coordinate their efforts and adhere to ensure the new transport policy. Coordinating the plans for the various modes will ensure that connection at interchanges both spatially and temporally, results in minimum trip disruption, discomfort, higher safety and security concerns (Phil Charles, 2019). Passengers want a comfortable, reliable and quick journey, with seamless connections from start to end (Phil Charles, 2019). Providing connecting information is critical to successful multimodal travel.
- Integrated infrastructure: Transport modes need to be seamlessly connected to enable the most convenient, comfortable and the highest quality of travel experience. Interchanges need to ensure seamless physical connections between modes, facilities and terminals (Phil Charles, 2019). This effort, therefore, requires good, functional and detailed designs of infrastructure to support the implementation. From a physical perspective, thinking about a traveller connecting from one leg of the journey to the next means designing the shortest, easiest, most comfortable and safe connection. Proximity and ease of connection will significantly improve user satisfaction; increase public transport patronage and transport sustainability (Ferreira et al., 2007).
- Integrated operations: After the provision of infrastructure, transport services need to be well coordinated to ensure seamless connections between services from origin to destination. Therefore, streamlining schedules, stops, fares, and passenger information makes it easier for passengers, to cut down on operational costs and boost operational revenue. (BEIJING, April 7, 2015). Passengers do not care about who is responsible. They just want connected trips. A simple, connected payment system, irrespective of whether using public or private transport and not be charged extra for connecting from one mode to another.

Even though passengers are demanding improved forms of mobility, the progressive integration of a competent, safe and secure intra- urban and inter-urban transport services is still lacking. It is therefore not surprising that Ghana drafted an urban transport policy and a national transport policy that emphasizes the need for an integrated multimodal transport system. Specifically, the National Transport Policy (2008) states that one of its objectives is “ to foster effective modal integration and economical assignment of traffic to modes through the market mechanism in order to minimise overall transport cost to users” (Ministry of Transport, 2008, p 14) remains unfulfilled.



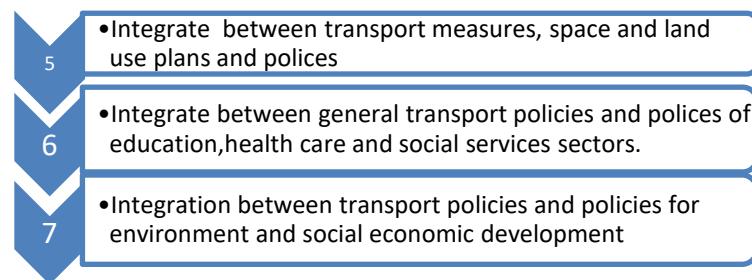
## Existing Transport Integration Framework

**Fig 1. Horizontal Integration framework**



Source: Adapted and drawn from Preston, (2012)

**Fig 2 Vertical Integration framework**



Source: Adapted and drawn from Preston, (2012)

In Fig 1, the existing integration framework that brings together different aspects of the transport system such as passenger transport travel information on available services, fares operators and operational infrastructure. However, Fig 2. Brings together all the activities, with aspects of governance such as integration of land use, plans and policies that affects socio-economic development and the environment.

## Identified challenges with the existing framework

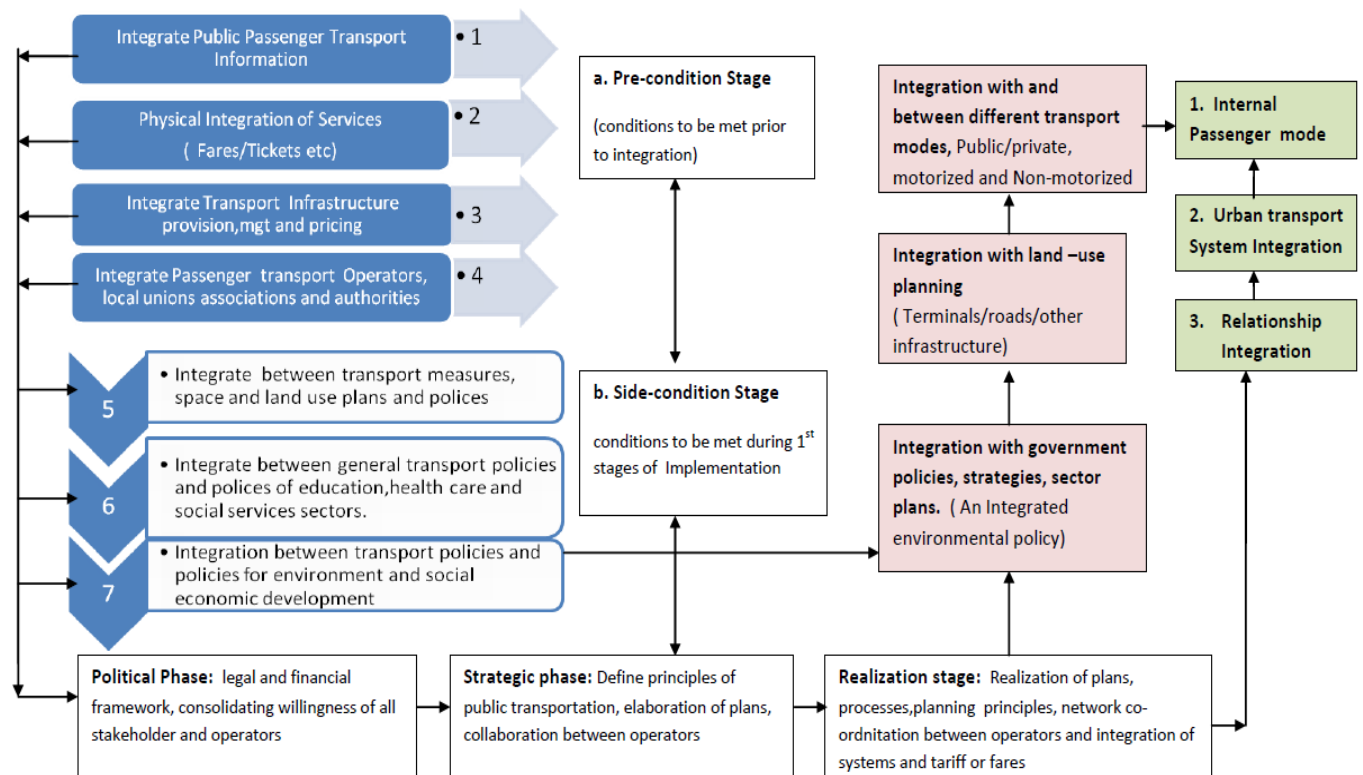
The above 7-steps integration ladder seems to suggest a growth in levels from smaller to higher as one goes through the steps one after the other, monitoring the situation, providing relevant information, showing alternative that will enable the passenger to make a choice and assuming that it will hopefully bring a change in behaviour through the introduction of financial and non-financial initiatives. The last few steps of the ladder also seem to suggest the application of restrictive policy measures. However, restrictive measures may result in agitation and discomfort from

both passengers and other operators

Preston, (2012) again assumes from the seven steps that passenger travel information can be quickly circulated to enable passengers to know the availability of a transport service, its location and perhaps the cost. However, these steps may be challenging to implement in countries and environments, where just a few people (passengers) have access to information on transportation services. Secondly, the framework may be challenging due to the traditional methods of passenger transport operation, which includes the operation of unscheduled services, operation by private individual transport owners, unplanned operation, with little or no regulation and no coordination among other modes of transport. After reviewing several mainstream theories and several frameworks, a new integrated framework is proposed.

### The new passenger transport integrated framework (Fig.3)

**FIG 3: New Integrated Passenger Transport Framework.**

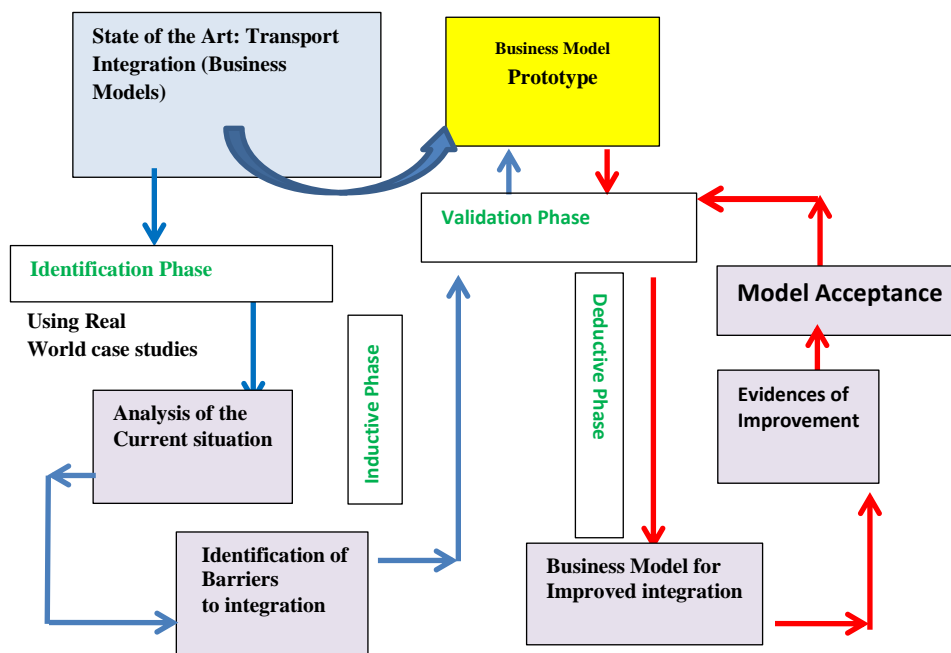


Source: A framework on integrating urban transportation. Adapted from (Preston, 2012), (SPUTNIC, 2011), NATA, New Approach to Appraisal and (Egis Bcom, 2015).

From the identified shortcomings, the author proposed a new framework developed from a combination of Preston,(2012) existing seven steps integration framework, the approach from Strategies for Public Transport in Cities, (SPUTNIC, 1998) and the framework from New Approach to Appraisal (NATA) (Walton & Shaw, 2003) which was later improved by(Egis Bceom International, 2015).

The author agrees with the existing framework that breaks the integration process into two categories being the horizontal transport integration, which brings together different aspects of the transport system and secondly vertical transport integration that brings transport activities together concerning governance (Fig. 1) and (Fig. 2). In terms of process, the first step, certain conditions must be met before integration. This step has been grouped into two stages. Firstly, the “Pre-condition stage”. Where certain conditions must be met before integration, these may include activities such as initiative taking activities to integrate transport modes, activities of operators and authorities to have a common understanding. It also includes plans and activities that link the integration of public and private transport systems. The stage creates a basis for network integration, and setting a political and strategic framework for operators, breaking down activities into daily operation levels. The second stage is the “side condition-stage”, which represents conditions that must be met during the first phase of the transport integration implementation. The plans and activities include the harmonization of different modes and operators of transportation, harmonise transport fares and ticketing arrangements. This stage also plans the establishment of travel time schedules where possible, as well as advertise travelling routes and connections to ensure reliability and quality of service.

**FIG: 4. The Business Model Approach of Transport Integration**



Source: Author field studies and Business Model adapted from V. Reis, R. Macario (2015)

Fig 4, represents a methodological approach deployed based on the development of case studies (Yin,2003). It was adapted from Reis and Macário, (2015). This business model is organised in four main phases being; the identification of barriers to integration phase, inductive phase, deductive phase and validation phase.

### **Identified barriers to integration.**

In developing a business model, there is the need to firstly analyse the current local transport situation, identifying any type of barrier such as physical, logical, economic, contractual, institutional, legal and regulatory interconnectivity types. Then using real case studies from various parts of the world, barriers militating against integration will be systematically eliminated. The activity of barrier elimination is vital because the successful elimination of these barriers will contribute towards reaching higher steps of the integration ladder (Reis & Macário, 2015).

At the induction phase, two sources of frictions are identified being, Firstly the frictions that relates to the transport links, towards the production of single-modal transport services. Then secondly the frictions that relate to the transfer nodes after the barriers have been located relating to the transfer process. This process resulted in the development of two business model prototypes that helped in overcoming specific gaps, to achieving an improved integration model, following the framework of (Osterwalder, Pigneur, & Tucci, 2005) and ( Osterwalder, 2010).

The deductive phase takes the current business model and finds ways to improve the model with pieces of evidence until an accepted model is established for validation. The purpose of this phase is to design new and better business models for improved integrated transport services.

The purpose of the validation phase is first, to assess the returns accruing from the implementation of the new business models and secondly gather evidence to support the validity of the business model prototypes. The validation tools could be selected according to the characteristics of each case study (Reis & Macário, 2015).

In order to appreciate and effectively develop and implement the business model for integrating multimodal and intermodal transport, one needs to consider this business model, which is organised into four main phases being; the identification of barriers to integration phase, inductive phase, deductive phase and lastly the validation phase.

## **4.0 Materials and Methods**

The purpose of this research is to examine the meaning, use and differences between multimodal and intermodal transportation systems. This research applied an empirical, analytical method by adopting the epistemological approach, which is using strong knowledge and how they can be obtained in reality. Even though the research was done using a mixed-method, i.e. a combination of qualitative and quantitative methods, the research method used was mainly qualitative. The qualitative methodology was done thematically in an explanatory inductive and deductive manner. The paper examined and found solutions to the research objectives being: to find the operational meaning, advantages, and differences between intermodal and multimodal transport systems. Secondly, the paper proposed ways transport integration can be achieved to benefit passengers, operators and all stakeholders through the drafting of a framework.

In arriving at the descriptions, explanations and findings in the paper, the author firstly used qualitative methods to collate and synthesize various articles, papers, materials and documents on the subject of intermodal and multimodal transport systems. This discovery gave a theoretical foundation and also guided the study.

To enable segmentation or sampling, transportation policymakers, professionals and policymakers were selected across all the various sectors of the transport industry. Firstly, the researcher conducted a survey on 783 passengers on the specific route that used either road or air transport. Then a list of thirty-one professional respondents, filled the policy interview questionnaire and six participants were selected based on their expertise in specific fields and interviewed on various aspects of intermodal, multimodal and transport integration systems to seek responses on questions relating to the subject matter as the interviews reached saturation. Using an individual in-depth interview style and also a structured interview type, we developed an interview guide.

The responses from the interview participants were recorded and later coded into themes and sub-themes to get a holistic account. Quantitatively, a survey questionnaire was designed and administered to transport operators of both road and air modes at the main Accra-Takoradi transport terminals in Accra, to seek their views on transport integration, intermodal and multimodal related issues and questions. The route was selected for the study because its planned policy decision and potential to operate multimodal transport services such as road, rail, air and sea modes. Using thematic analysis, the findings of the studies were all recorded and analysed.

## 5.0 Results

### Quantitative results

Reference to Table 2, respondents were asked “what must be done by Government and local authorities to implement an integrated multimodal passenger transport system? Thirty-one, (31) professionals were asked to state their opinion in a questionnaire. The results showed a high percentage of agreement (71%-100%) overwhelmingly and strongly agreed to the drafting of laws, policies and regulations, promotion of policy to develop both the private and public operators. They all also strongly agreed with supervision and management of safety and security issues, strengthening cooperation nationally amongst operators and sharing passenger information, fares, vehicle location and capacities of both vehicle and terminals. There was, however, no clear opinion but a split decision half in favour and the other half disagreed on the need to allow completion between public and private operators and each group of operators determining their fares and route of operation.

**TABLE 2: Respondents concerns on the implementation of an integrated passenger multimodal system**

What must be done to implement an integrated multimodal passenger transport system? Govt. & Local Authorities need to.....		Strongly Agree %	Don't Agree %	do not know %	Not sure %
Formulating transport & terminal integration development strategies & plans	Strongly agree	93.5	-	3.2	3.2
Drafting multimodal & intermodal passenger laws, regulation & policies relating to current & future development	Strongly agree	100.0	-	-	-

Promotion and development of a national passenger transport policy for both private and public transport operators	Strongly agree	80.6	9.7	-	9.7
Exercising supervision and management over the urban transport market & maintain fair competition	Strongly agree	87.1	6.5	-	6.5
Being responsible for supervision ,training, management & enforcement of safety & security issues	Strongly agree	77.4	6.5	6.5	9.7
Strengthening national cooperation between groups of operators	Strongly agree	71.0	9.7	3.2	16.1
Allow all operators both private and public compete against one another & determine own fares & routes	Split	41.9	41.9	6.5	9.7
Sharing of passenger transport information such as fares, services, location and capacity of terminal to all operators	No clear decision	83.9	6.5	-	9.7
Formulating transport & terminal integration development strategies & plans	Strongly agree	93.5	-	3.2	3.2
Drafting multimodal & intermodal passenger laws, regulation & policies relating to current & future development	Strongly agree	100.0	-	-	-

Source: Field Research 2018

## 5.1 Qualitative responses

Qualitatively, respondents were selected and interviewed on various issues related to intermodal and multimodal transport and transport integration systems. To answer the question “to what extent has the challenges besetting the multimodal and intermodal passenger transportation system affected its implementation?”. Selected transport experts and professionals from the industry and public sector ministries were interviewed.

### No apex authority responsible for the system

One major challenge revealed by the respondents was the lack of an apex authority that is responsible for the transport integration and multimodal systems. It was further revealed that there is no specific transport authority which controlled how the entire national integration system should be structured.

*“Currently there are so many transport ministries... one for Aviation, one for Railway development, then Roads and transport, and others. Who is responsible for entire policy and regulation on multimodal transport?”* (Participant 4, Male, Officer, Ministry of Aviation). Additionally, it was revealed that, as a result of this challenge, there is very little coordination and perhaps no active policy direction leading to the practical construction and implementation of a multimodal passenger transport system. This challenge further led to the lack of proper coordination and proper collaboration between the various transport operators and unions over the years.

### **Poor planning of urban communities.**

Another challenge that continues to plague the effective operation of intermodal and multimodal passenger transport systems, according to the respondents is poor planning of the urban communities. According to them, due to poor planning, it has become quite difficult for some of the new transport organisations to establish their presence in some areas and communities.

It was further added that this challenge had caused significant congestion in our cities and the weak linkages to some areas in the urban communities. It was found that some road transport terminals are not well planned in terms of the best location. They just emerge as a result of a few operators coming together along the roadside or acquire land somewhere and then start operating. These terminals soon turn into a market of various vendors and then a whole business community is developed later, creating further congestion and environmental challenges.

### **Lack of funding**

The lack of funds that affect governmental and non-governmental agencies as well as these transport operators hinders the implementation of an effective intermodal and multimodal transportation system. Participants unanimously agreed that operators, non-government agencies and stakeholders, each lacked adequate funds and resources to construct infrastructure for an effective integrated transportation system. Transport operators added that they do not receive any form of funds from the government to develop and improve their services and infrastructure. Instead, the heavy operational burden is supported by private sources, and this has led to some transport operators reluctant to contribute financially to physical infrastructure and terminal development because according to them, they barely make a profit from the operations.

*“At the end of the day, all these nice initiatives need funds to implement. Where are the funds from operators, government and other stakeholders?”* (Participant 11, Male, Road Safety & Transportation Consultant).

### **Lack of pricing scheme**

Further interaction with the participants also revealed that the lack of a pricing scheme was another major challenge. As far as intermodal and multimodal transportation is concerned, most of the respondents expressed their displeasure to the fact that there is no uniformity in pricing or no pricing scheme which regulates how transports systems should charge their fares. As a result of this, some transport operators charge outrageous fares while others also deliberately charge low fares to attract more passengers. This uneven fares sometimes confuse passengers. Additionally, it was also revealed that, due to the lack of a proper transparent pricing scheme, there is often agitation between these transport operators and their passengers.

### **Poor roads linkages**

Another challenge outlined by the participants that hindered the effective intermodal and multimodal transport system is the poor road and transport infrastructure linkages. Poor roads within the cities and the rural areas continue to be a major headache for most transport operators.

*“I recall travelling on the Accra-Takoradi road and running over numerous and dangerous self - community constructed speed ramps, large potholes on the high way. They are all over, and I counted over 60 groups of such speed ramps along the route from Mankessim to Takoradi”* (Participant 11, Male, Road Safety & Transportation Consultant)

According to the respondent, transport accessibility is compromised due to operators inability to reach some vital urban areas. They recounted instances where some of the roads had been damaged to the extent that, it was impossible for buses or other vehicles to even travel on them and this makes the transportation of passengers to such areas very difficult. Additionally, they also recounted instances where roads have been constructed very poorly without any form or drainage systems, and as a result, when it rains, the roads become very flooded making it impossible for vehicles to travel on them.

### **5.1.2 What challenges are affecting the implementation of integration**

Based on the responses of participants, the following subthemes were generated,

#### **Payments of one fare from origin to destination**

It was also found that multimodal transportation enabled passengers to benefit from one standard fare across the journey regardless of the number of transport service selected. This initiative calls again for cooperation among operators and the establishment of standard tariff or fare systems operationally based on distance travelled. For this, to work there is the need to have an active electronic ticketing system to ensure passenger benefit from one ticket or one fare per trip along a selected route.

#### **Use of different modes of transport services**

It was found out that one another benefit of using a multimodal urban transport system is the ability for passengers to benefit from the use of different modes of transport service along the journey based on distance travelled.

*“I don’t know why I have to wait for hours for a bus to Takoradi when the government could have introduced a railway system on the route or introduce a cruise vessel on the sea along the coast to Takoradi.”* (Participant 11, Male, Road Safety & Transportation Consultant)

*“Congestion along the route and accidents could have been reduced or prevented if we had other alternative means of travelling to my destination”* (Participant 31, Male, Transport & Logistics Consultant)

It was also found that because urban transport systems are mainly uni-modal in operations, Multimodal transport terminals have not been developed to serve different needs of passengers along the route. Passengers, therefore, have no choice but to use what is available.

#### **Lack of scheduled urban transport services**

The study found that contrary to what exists today, another benefit of a multimodal transport system is the ability for operators to schedule their transport services based on time of departure or arrival at various terminals along the route. It was found that it is only one bus transport operator, i.e. Inter-City STC that applied a scheduled system along the route. Secondly, the only domestic airline operating the Accra-Takoradi route being Africa World Airline operated a scheduled domestic flight service. Even though there were often delays in operating these schedules, it was deemed to be better than no schedule at all. *“Passengers have no choice, and they have to sit and wait in hot vehicles till each vehicle is fully loaded before it leaves the terminal”* (Participant 22, Male, Ministry of Aviation)

*“Due to lack of scheduled time of departure, I cannot plan my journey time because all intercity movement depends on when the last ticket is purchased”.* (Participant 11, Male, Road Safety and Transportation Consultant)



### **Lack of policy direction**

The lack of policy direction was the most critical and pertinent issue according to the participants that prevented the need for coordinated action and integrated passenger transportation system. From their responses, it can be suggested that, even though the National Transport Policy seems to suggest a clear policy on operating intermodal and multimodal transportation systems in the country, this policy does not give a clear direction as far as its implementation is concerned. However, this has led to a series of concerns being raised among transport operators. Some of these issues include who will supervise the entire implementation project, be responsible for accountability, monitoring and evaluation, guidelines on how this can be achieved, among others. Eventually, the respondents said these issues have led to suspicion and lack of trust in the system and among other transport operators. Further interaction also revealed that the lack of policy direction had caused others to have a deep fear of failure. Some operators feared that *“if this transport service integration works, someone will take over our transport business”*. (Operator at VIP terminal).

### **Lack of alternative modes of transport**

Another major issue from the perspective of the participants is the lack of available, alternative modes of transport systems in the country. According to them, there are only a few transport modes in the country, which implied that passengers do not have much choice as far as getting access to different modes of inter-urban travel is concerned. We seem too focused too much on the road sector and not encouraged others to develop.

*“I don’t know why we have to wait for hours for a bus to Takoradi when the government could have introduced a railway system on the route or introduce a cruise vessel on the sea along the coast to Takoradi.”* (Participant 31, Male, Transport & Logistics Consultant)

*“Apart from choosing between the bus operators along the route, there is no other affordable alternative transport mode for passengers. No railway alternative.”* (Participant 24, Male, CILT Governing Council Member)

However, this gives the impression that the implementation of an integrated passenger transportation system will be challenging to achieve as a result of these few modes of transport. There is, therefore, the need for government to reconsider the railway development policy along the route and perhaps find other alternative modes such as the implementation of a passenger cruise vessel operation on the sea along the Accra –Takoradi route.

### **The high cost of transport services**

Another issue raised by the participants that may hinder multimodal passenger transportation operation is the high cost of transport services. It was revealed that setting up of a transport service required much funds, which, according to the participants, was challenging to raise. As a result, there is low investment in the transport industry. Additionally, due to the lack of a pricing or fare scheme that regulates how much fares should cost, has made most transport operators design their pricing schemes based on hikes in fuel prices which are not uniform. This lack makes it difficult for new transport operators to attract enough passengers to generate enough profit from their operations, let alone contribute towards the development of a multimodal passenger transportation system.

### **Personnel are without requisite professional training and skill needed for the system.**

It was further revealed that the transport industry according to the participants had inadequate literate and professional personnel who have been well trained and have operational skills and enough competences to champion this mode

integration project and sustain it. For instance, there is no law or regulation governing operators of road transport services. *“In many developing countries, anybody can operate a taxi, trotro or buses service as long as he has funds to purchase a second-hand vehicle, convert it to commercial use by creating seats in these vehicles”* (Participant 11, Male, Road Safety and Transportation Consultant)

*“Unfortunately I see that one does not need to be educated in transport management or operation to operate a transport service. ...this is affecting the quality of service”* (Participant 31, Male, Transport & Logistics Consultant). They also added that they lacked the necessary resources, including funds and infrastructure, to undertake such a project on their own as operators.

## **6. Discussion of Results and Contributions**

In this paper, clarity has been established in the definition, explanation, advantages and differences between intermodal and multimodal transport systems. The need and reasons for the proposals for transport system integration have also been clearly explained, adding to the efforts made by many governments, to integrate transport planning and operations to benefit all stakeholders.

It was overwhelmingly agreed by respondents that, Government, Municipal and Local Authorities must ensure:

- The formulating transport & terminal integration development strategies & plans
- Drafting multimodal & intermodal passenger laws, regulation & policies relating to current & future development
- Promotion and development of a national passenger transport policy for both private and public transport operators
- Strengthening national cooperation between groups of transport operators
- Being responsible for supervision, training, management & enforcement of safety & security issues
- Exercise supervision and management over the urban transport industry and maintain fair competition.
- Sharing of passenger transport information such as fares, services, location and capacity of the terminal to all operators

However, there was no clear position by respondents on the need to allow all operators both private and public, to vigorously compete against one another & determine own fares & routes.

The paper also investigated the kinds of opportunities that are available for operators of intermodal and multimodal transportation. Based on the qualitative responses of the participants, it was established that there is the need for easy access to all modes of transport, this is expected to increase passenger and cargo patronage, increase revenue, and create healthy competition. There is a need for right collaborations between all transport operators with the regional or zonal framework. The opportunities for an effective multimodal transport system included benefits such as a seamless and continues flow of services, payments of one fare from the point of origin to destination, the use of different modes of services and the benefits of applying planned scheduled transport services.

Even though these opportunities exist, there are also challenges associated with effective intermodal and multimodal passenger transport system. These include the lack of an apex authority responsible for the transport system, poor planning of urban communities, lack of funding to support the project, the lack of an agreed pricing scheme and poor roads and transport infrastructure linkages.

The current state of the integrated passenger transport system was examined in line with the government's objectives and policies. *"Subsequently, the introduction of an integrated transport planning process from which this, Ghana's first Integrated Transport Plan (ITP), has been produced, further reinforces and facilitates the transition to a strategy-led approach,"* (Ministry of Finance and Economic Planning & Egis Bceom, 2010, p 17).

It was found that governments' commitment is low and lacked the political will to implement transport integration. Some issues that may prevent integration are the lack of a policy direction, the lack of alternative modes of transport along various routes in the country, the high cost of transport services, inadequate personnel well trained with skills to implement and operate the initiative and the lack of resources needed for the system.

## **7.0 Conclusion**

The confusion surrounding the explanation of intermodal and multimodal transportation in literature has been addressed. The differences, advantages of the transport systems have been thoroughly explained. The also paper enumerated the need and benefits of transport integration. A conceptual model and a new framework for transport integration and well as a business model have been developed to solve the deficiency of the existing horizontal and vertical integration framework.

Respondents were of the view that government should spearhead the initiative of transport integration, supervises the successful the implementation, facilitate by outlining some rules and regulations that will govern the implementation as well as ensuring the enforcement of these laws. Furthermore, respondents suggested that government could ensure the engagement of all stakeholders, provide education on the importance and benefits to all stakeholders to arouse their interest and full engagement and create an enabling environment for the various modes of transports to collaborate effectively to ensure the optimization of productivity.

The government could provide or create transport hubs at strategic locations across the country and operate scheduled transport services as a means of facilitating the multimodal and intermodal transport systems. These hubs should be created along the economic and geographical zones that are easily accessible to passengers.

The benefits of transport integration include overall improved quality of service, including a reduction in travel and waiting times, better service coverage, a single fare or ticket to cover the whole journey from beginning to the end and may eventually result in a reduction in tariffs. Transport operators can also expect an increase in patronage due to the travel network effects or an eventual cost reduction owing to the elimination of network redundancies or better utilisation of resources and infrastructure.

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