

Intermodal Road-RoRo Transport in the Philippines, its Development and Position in the Domestic Shipping

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Abstract: This study aims to present the development of the intermodal road-RoRo transport in the Philippines and its current position in the domestic shipping market. A review of the Road-RoRo Terminal System (RRTS) is provided, as well as its development and impacts since implementation in the country. A questionnaire survey with freight forwarders as respondents was conducted to determine the cargo volume shares of intermodal transport. The survey also revealed that travel time followed by transport cost are the top influential attributes in choosing intermodal transport over inter-island shipping and air transport. Transport costs and travel times for transport from Manila to selected destinations were estimated and compared for the two modes, which give insight on the preference of intermodal transport for some of these destinations.

Keywords: Intermodal Transport, Roll-on Roll-off Vessel Transport, Philippines

1. INTRODUCTION

The Philippines is an archipelago of 7,107 islands. Because of its geographic characteristic, maritime transport has been the major means by which cargoes are moved between islands. From the National Statistics Office (NSO) 2013 data of Commodity Flow, 99.80% inter-regional commodity trade is done by water; with the remaining percentage done by air transport. The Philippine Ports Authority (PPA) port system is the most important and extensive ports network existing, with 239 public ports and over 349 registered private ports in PPA administrative and operational jurisdiction (Javier, 2008). The Road-RoRo Terminal System (RRTS) established in 2003 is the more recent addition to the port system. It is a network of terminals all over the country linked by RoRo vessels, and which goal is to provide greater access to the island provinces and better integration among the different regions. The RRTS is said to be a success story for the archipelagic country, but a study by Kobune (2008) shows that the advantage of RRTS is overemphasized only for its quick procedure at terminals (because transport through RoRo does not require cargo handling), and is competitive to the inter-island shipping in terms of total transport cost only within 200km distance. Thus, this study aims to present more understanding on the current position of intermodal road-RoRo transport in the Philippines, its advantages over the conventional or container means of inter-island shipping, and the

attributes that influence mode choice by providing literatures reviews, conducting field survey and survey interviews with freight forwarders.

To define, intermodal transport is the movement of goods in the same loading unit or vehicle by successive modes without handling of goods when changing modes (Bontekoning et. al., 2004). Meanwhile, RoRo operations in the context of the RRTS policy is the loading and discharging of self-powered vehicles on their own wheels by their owners or drivers between vessel and shore via a ramp into RoRo vessels servicing the RRTS (Executive Order 170 and 170-A, 2003). Thus, intermodal road-RoRo transport in this paper is categorized as the transport of self-powered vehicles (cars, trucks, and trailers with prime-movers) through land and through sea by RoRo vessels. While in contrast, inter-island shipping transports cargoes in conventional manner (in pallets) or by containers which are loaded into and off the vessel by forklifts or cranes, not in intermodal manner.

Several studies have been published tackling mode choice decision bases for RoRo shipping as part of an intermodal system. This present study, however, is unique in that for the archipelagic context of the Philippines, the vehicles in road-RoRo intermodal shipments traverse chains of islands and seas (or several land and sea legs) to compete with the long-distance container shipping. This is contrary to the short sea shipping (SSS) and motorways of the sea employed in other regions (e.g. Europe, Asia-Europe, Northern America and Australia) where intermodal systems generally only involve one sea leg and often are in competition with land-based transports. Torbianelli (1999, 2000), though, provides the advantages of maritime RoRo transport over container transport namely (a) greater time efficiency since routes are shuttles and not intertwining as that of container vessels which causes frequent transshipment and waiting, (b) less time consuming cargo handling at ports, (c) semi-trailer exploits greater loading conditions and dimensions (greater volume, refrigerated units etc.) compared to containers, and (d) it allows transport companies a sole continual physical connection with their vehicle thus they could maintain economic and quality control of the whole transport chain. Comparison by Woxenius (2012) states that the SSS ferries have very high commercial and technological flexibility as they have very open interface between cargo and passengers and accept virtually anything allowed on the road, while container feeder vessels have high commercial openness due to the small parcel size and the large adoption of containerization over the years but is specialized in its containment unit. While Paixao and Marlow (2002) report that both ships compete with land-based transports in different distance coverage partly due to logistics cost; RoRo on short distances with road transport and container ships on long distances with the rail mode. Containers are the least expensive mode of carrying goods while RoRo has higher inventory costs thus lack competitiveness over long distances and, moreover, quick turnaround time is critical for operation in short routes.. For the studies on mode choice, Puckett *et. al.* (2011) reveal that shippers' choice between SSS and truck in the Atlantic Canada-US eastern seaboard market is strongly sensitive to cost and frequency of departure. Feo *et. al.* (2011), using stated preference survey with Spanish freight forwarders with south-west Europe shipments, report that cost has the greatest effect with other significant parameters being transit time, delivery time reliability and service frequency. While D'Este and Meyrick (1992) found that the top factors in the choice of RoRo carrier are in the order of frequency, reputation for punctual delivery, transit time, price and response

to problems being of particular concern. Their survey results largely confirm the findings of several earlier studies, while acknowledging that local conditions can affect the relative importance of particular decision factors. Meanwhile, Paixao-Casaca and Marlow (2005) identified the factors/service attributes essential for a more competitive multimodal service in Europe, namely, carrier logistic network design and speed, cost of service and reliability/quality, carrier's representatives sales and after-sales behavior, investment policy, corporate image, commercial/operational and carrier-shippers' relationship policies, involvement in the forwarding industry and service guarantee. Moreover, Lopez-Navarro (2013) shows evidence that shared planning between road transport firms and shipping companies positively benefits intermodal citing the presence of incentives for collaboration, the importance of trust within the relationship, and the positive effects of adaptation of road transport firms to their shipping companies. Thus, this paper attempts to consider the above mentioned mode choice attributes and report on which are of most importance in the choice of freight mode in the Philippines, which information could be used as baseline data for future plans/ studies regarding intermodal transport improvements in the country.

Thus, the succeeding sections of this paper are organized as follows: Section 2 details the development of intermodal road-RoRo in the Philippines and the impacts of the RRTS. Section 3 details the results of a questionnaire survey conducted with freight forwarders as respondents. Here, transport cost and travel time of intermodal transport and long-distance sea transport are presented. Section 4 summarizes and concludes the study.

2. THE DEVELOPMENT OF INTERMODAL ROAD-RORO TRANSPORT IN THE PHILIPPINES

2.1 RoRo Transport Prior to RRTS

Roll-on Roll-off system or RoRo is designed to carry rolling stock cargoes which are simply rolled on and off the vessel. This is as opposed to the load-on load-off (Lo-Lo) or conventional liner system where goods are shipped in containers, loaded and off-loaded by cranes and other dock equipment (ADB, 2010). RoRo vessels started arriving in the Philippines in 1970s, the first could have been the Millennium Uno from Japan in 1973 (Baylon, 2015). Since then, the Millennium Uno has been servicing Millennium Shipping and is plying the Liloan-Lipata route of the Eastern Nautical Highway. In 1978, "Northern Samar" of Eugenia Tabias Shipping Lines also started sailing the Sorsogon-Samar route (Baylon, 2015). RoRo ferry service between Batangas City and Calapan, Mindoro island also began operations in the 1970s, which facilitated the supply of food products from Mindoro to the capital Metro Manila (Kobune, 2008).

The concept of RoRo ferry service as part of the highway system was first introduced in the Pan Philippine Highway, which was conceptualized in 1965 (Basilio, 2008). Pan-Philippine Highway, also known as the Maharlika Highway, is a network of roads, bridges and ferry services across the eastern part of the Philippines connecting the islands of Luzon, Samar, Leyte and Mindanao.

However, it was only in the 1980s when RoRo ports along this Highway, namely, between Matnog (Sorsogon, Southern Luzon) and Allen (Northern Samar), and between Liloan (Southern Leyte) and Lipata (Surigao del Norte), were built for the exclusive use of RoRo service. In 1983, Maharlika I and Maharlika II started operations in these links. But it is known that even before then, the private sector already utilized RoRo vessels by using existing and makeshift ports and wharves, some of which were privately built. Examples of these were the prior mentioned Millennium Shipping and Eugenia Tabias Shipping Lines that serviced the links of the Eastern Nautical Highway even in the 1970s (Baylon, 2015).

Other RoRo routes soon followed. Manila International Shipping and Viva Lines pioneered the services between Southern Luzon through Batangas and Lucena with provinces of Mindoro, Romblon and Marinduque. Short-distance services across the islands of Visayas were pioneered by Gothong Shipping, Aznar Shipping and Maayo Shipping which primarily carried vehicles. In the 1980's, liner companies such as Negros Navigation, Sulpicio Lines, Gothong Shipping, and Trans-Asia Shipping already had RoRo vessels that served overnight and short-distance routes (Baylon, 2015). Non-vehicle cargoes were commonly shipped as loose cargoes or in pallets loaded into the vessel using forklifts. Perhaps wheeled cargoes such as trucks were not popular then because the freight charges for self-powered vehicles were in cubic meters; contrary to the present where, by RRTS policy, charging is made in lane meters. Thus, a significant amount would be paid for the volume of the vehicle, in addition to the intended cargo. It would be more economical to transport the cargoes to and from the ports by trucks but unload/load them to and from the ship at ports.

Though RoRo services were present in the two sea links along the Pan-Philippine Highway which could have seamlessly connected Luzon to Mindanao, long-distance intermodal transport could not been used in its full potential because of the then poor condition of some roads. In 1997, further improvement of the Pan-Philippine Highway had to be done with the addition of 600 kilometers of road from Sto. Tomas, Batangas to Matnog, Sorsogon (ADB, 2010).

The 1980s also saw the surge of containerization in the domestic shipping which began with 10-footer and 20-footer containers. In the 1990s, 20-footers dominated, with 40-footers present mainly for transshipments for foreign ports. Containers are also carried by RoRo vessels and are loaded and unloaded using forklifts or mounted on trailers and pulled by tractor heads to speed up the process. The latter is also a form of intermodal transport. However, container with prime mover in RoRo vessels is charge higher than the other vehicles (e.g. 10-wheeler truck) and is not charged per lane-meter because of its heavier material composition (Montenegro Lines, 2014). Container on chassis is not considered a self-powered vehicle thus, as per Executive Order 170, could still be burdened by transport procedures and additional costs in loading into a RoRo vessel. Moreover, container vessels have the capacity of stacking containers on top of each other which could realize scale economies; whereas RoRo vessels commonly only have one deck for loose, palletized and rolling cargoes, and have the upper decks for passengers.

Prior to the inception of the RoRo policy in 2003, the predominant method for domestic shipping is by container vessel which uses the load-on load-off system facilitated by cranes and dock equipment (ADB, 2010). This system presented significant cargo handling and wharfage costs.

2.2 Inception of the RoRo Policy

According to an ADB (2010), during the various conferences held in Mindanao in 2002, one of the persistent issues raised by shippers was the high cost of transport from Mindanao to Manila. Many could not understand why certain domestic shipping is more expensive than shipping from Manila to Hong Kong, China or Bangkok. Cost and inefficiency of cargo handling charges were identified as the major factor in the high cost of domestic logistics transportation, as they attribute to up to 30% of the sea transport costs. Extensive use of RoRo shipping is recommended as the most appropriate for an archipelagic country because it goes away with port-related activities (ADB, 2010). However, the RoRo recommendation was not readily implemented. Various reports attribute this to the lack of interest from PPA (Basilio, 2011).

PPA is vested the role to own, develop, maintain, operate and generate income from its ports. PPA as the operator outsources terminal operations such as cargo-handling to the private sector and in turn collects 10-20 percent shares from cargo-handling revenues. As per PPA approval, cargo-handling rates increased annually from 1998-2008. PPA is said to be biased with cargo-handling such that the more cargoes handled and the higher the rates, the higher is the income of PPA (Basilio, 2011). In effect, most shipping lines converted their RoRo ships to accommodate cargo handling, and some of them even went to cargo handling business themselves. And, cargo-handling was imposed even though no cargo-handling service was actually provided; only the false pretense that the ports are not equipped to handle RoRo ships.

There was then a strong clamor for reform from the business sector. Thus in 2003, the Executive Order 170 was enacted that orders the elimination of any costs and procedures that are not required in land-based transportation systems such as cargo handling charges and wharfage dues. The order also promotes RRTS by changing the basis of freight charge to lane meter, by simplifying documentary requirements, waiving port authorities' share in port revenues, encouraging privatization of public RoRo ports, requiring only minimum permit in port construction and operation, and providing available financing from the Development Bank of the Philippines for investments related to this cause.

RRTS was also promoted as a solution to the absence of connectivity of rural islands to economic hubs such as Manila, Cebu, etc. Isolation and lack of connectivity of the island provinces are important factors which contributed to poverty and underdevelopment. They serve as major constraints to economic and social interaction and integration, giving limited incentives to increasing production (because of relatively small market). With inefficient transportation, increase in agricultural production only led to wastage and spoilage (ADB, 2010).

2.3 The RRTS and its impacts to development and logistics operations

2.3.1 RoRo routes and inter-island shipping routes

The RRTS also called the Strong Republic Nautical Highway (SRNH) has 3 main trunklines –

Eastern Nautical Highway, Central Nautical Highway and the Western Nautical Highway shown in Figure 1. There are also lateral RoRo links, examples of which are those connecting the islands in the Visayas as shown in Figure 2.



Figure 1. The three main trunklines of the Strong Republic Nautical Highway



Figure 2. Lateral RoRo Links in the Visayas

Moreover, RoRo links also connect the islands of Cuyo, Catanduanes, Romblon, smaller islands of Cebu and Southwestern Mindanao to the bigger main islands or urban economic nodes. Aside from the short distance RoRo links, there are RoRo vessels that sail long-distance such as the routes of Manila-Cebu-Cagayan de Oro, Manila-Cebu-Butuan, Manila-Cebu-Dumaguete-Zamboanga, Batangas-Calapan-Odiongan, Manila-Cebu-Davao-General Santos, Manila-Batangas-Iloilo-Bacolod-Cagayan de Oro, etc.

In 2008, there were 68 existing RoRo routes served by 49 shipping companies operating more than 250 RoRo ships (Basilio, 2008). The trunklines of SRNH alone serve 919 kilometers covering 17 cities, towns and islands. As of December 2013, the 3 trunklines have multiple trips per day as shown in Table 1.

Table 1. Daily trip frequencies of short-distance RoRo links along the 3 nautical highways

Routes	Number of Operators	Trips per day
<i>Western Nautical Highway:</i>		
Batangas City – Calapan, Oriental Mindoro	4	37 toward, 36 return
Roxas, Oriental Mindoro – Caticlan, Aklan	2	6
Dumangas, Iloilo – Bacolod, Negros Occidental	3	19
Dumaguete, Negros Oriental – Dapitan, Zamboanga del Norte	3	5
<i>Central Nautical Highway:</i>		
Pilar, Sorsogon – Masbate City, Masbate	1	5
Cawayan, Masbate – Bogu, Cebu	1	2
Cebu City – Tubigon, Bohol	3	9
Jagna, Bohol – Balbagon, Mambajao, Camiguin	1	2
Benoni, Camiguin – Balingoan, Misamis Occidental	3	18 toward, 16 return
<i>Eastern Nautical Highway:</i>		
Allen, Northern Samar - Matnog, Sorsogon	3	7
Liloan, Southern Leyte - Lipata, Surigao del Norte	3	7

Source: Maritime Industry Authority (MARINA, 2013) and retrieved from interview

As of December 2013 data, there is no operation between Pilar, Sorsogon to Aroroy, Masbate and Cawayan, Masbate to Daanbantayan, Cebu (MARINA, 2013). Alternatively, RoRo operations by Montenegro Lines for Pilar to Masbate City port, and Cawayan to Bogu, Cebu are listed in the Table 1. Moreover, there is also a daily RoRo service from Batangas directly to Caticlan by Montenegro Lines. The multiple trips per day of short-distance RoRo is contrary to the less frequent trips of overnight and long-distance RoRo and container vessels that commonly only have at most one trip per day for each route per shipping company.

Gathered from PPA, Table 2 shows the weekly trip frequencies and available destinations served with Manila as origin by 9 shipping companies namely Aleson Shipping Co., Solid Shipping Lines, 2GO Group Inc., Carlos A. Gothong Lines, Gothong Southern Shipping Lines, Lorenzo Shipping Co., Moreta Shipping Company, Phil. Span Asia Carrier Corp. and Asian Marine Transport

Corp. Escano Lines Inc., Loadstar Shipping Co., Seaford Shipping Lines, National Marine Container Lines and Oceanic Container Lines Inc. also service the ports of Manila but their information are not included in the Table. From Kobune (2008), daily services are available only along the routes of Manila-Cebu-Cagayan de Oro and Manila-Iloilo-Bacolod. The other routes only have 1-3 services per week.

Table 2. Less frequent weekly trips of long-distance inter-island shipping originating from Manila

Destinations from Manila	Number of Operators	Trips per Week
Cebu	6	22
Cagayan de Oro	5	14
Bacolod	4	8
Iloilo	3	9
Nasipit	2	5
Davao	3	5
General Santos	3	5
Zamboanga	3	4
Puerto Princesa	2	3
Tacloban	1	3
Ozamiz	3	3
Roxas City	1	2
Dumaguete	2	2
Iligan	2	2
Cotabato	1	2
Masbate; Romblon; Coron; Dipolog; Tagoloan, Misamis Oriental; Ormoc	1	1

Source: Retrieved from shipping companies websites (September 2014)

2.3.2 Impacts of RRTS

ADB (2010) and Basilio (2008) have written impact assessments of RRTS. There were notable area development, restructuring of inter-island shipping, changes in cargo mobility, logistics operations and strategy, increased agricultural productivity and enhancement in tourism since the implementation of RRTS; and each of these impacts are detailed in the following paragraphs.

In Roxas, Oriental Mindoro, new commercial establishments mushroomed after the port of Dangay came into operation. Real estate prices increased from P500-P1,000 to P5,000-P10,000 in 2010. From 2003, tax collections from business enterprises amounting to P2 million per year were added to the municipal total income. Meanwhile, port-related revenues in Pilar, Sorsogon increase by 84% when Montenegro shipping started its RoRo operation connecting Pilar to Masbate island.

Market developments brought by the RoRo policy heightened the level of competition which pushed existing players to restructure their operations. For example, the then Aboitiz Transport System (ATS) launched its RoRo service (former 2GO company). Also, Manila as inter-island gateway port was significantly reduced. There are no longer liner vessel servicing Mindoro from Manila, and the long-distance shipping from Manila to Panay has been reduced to just the port of Iloilo.

Vehicle numbers passing through SRNH also significantly increased (Figures 3 and 4), more notably for the Western Nautical highway. Aside from the RoRo policy, other factors also contributed to the shift in the cargo shipment to the intermodal road-RoRo alternative, namely, increases in fuel prices which prompted operators to sell old and less fuel efficient vessels; vessel accidents which caused suspension of shipping lines (e.g. Princess of the Stars of Sulpicio Shipping Lines); and the higher frequency of RoRo vessels trips which allows little lead time.

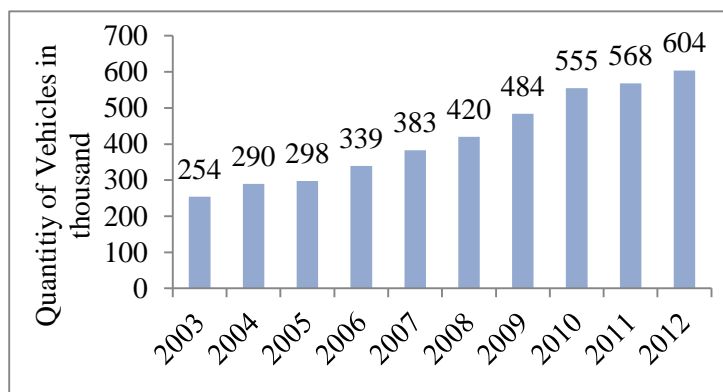


Figure 3. Number of Vehicles Passing through the Western Nautical Highway

Source: PPA Statistics

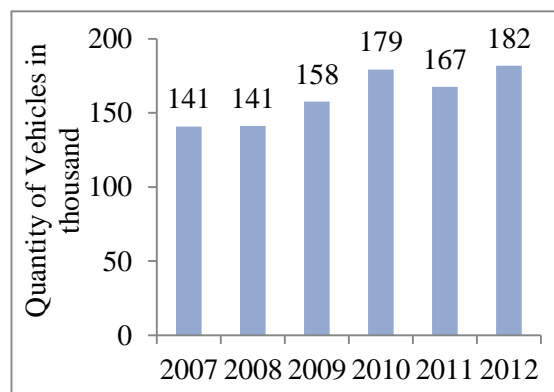


Figure 4. Number of Vehicles Passing through the Eastern Nautical Highway

Source: Estimated from PPA Statistics data

The developments brought by the policy also prompted some companies to change their logistics operations and strategy. For Nestle Philippines, because of the RoRo network they are able to make small, frequent and direct deliveries to clients ensuring product safety and shorter lead time. In turn they could reduce their distribution centers, closing 32 out of 36 of the centers around the Philippines, and minimize the need for inventories. On the other hand, Universal Robina Corporation, a food manufacturing company, is enabled to deliver 12 trucks trips a day through SRNH from the previously one shipment a week via liner shipping. Gardenia Bakeries was also able to expand to new market when the Western Nautical Highway became operational. Each round trip from its Laguna plant to Iloilo only costs P21,000 using RoRo as opposed to P25,00 per 20-foot container by the traditional shipping. Frequent RoRo trips enables shorter lead time and faster deliveries giving them longer number of days to sell the bread products.

The efficiency in transporting by RoRo network also encouraged farmers to increase their production to take advantage of opportunities to increase income. SRNH, especially the Western Nautical Highway, opened up new markets to farmers. Fruits from Davao such as mangosteen and durian found new markets in Iloilo and Bacolod. Some of the vegetable shipments to Caticlan and Iloilo originate from Baguio. Fish shipments from Estancia to Manila increased from once a week using traditional shipping to daily via RoRo.

The RoRo links along the Western Nautical Highway enable easy access between tourism gems of the western Philippines. Dangay Port in Roxas, Mindoro Oriental links tourists from Puerto Galera to proceed further to Boracay Islands in Aklan (and vice versa). Greater accessibility and affordability are provided in travelling to Panay island, to Negros island and even down to Mindanao

to visit tourism destinations in Dapitan.

3. INTERMODAL ROAD-RORO IN THE CURRENT DOMESTIC SHIPPING

3.1 Field Survey Method

To better understand the market of intermodal road-RoRo transport in the Philippines, a field survey was conducted in Metro Manila on 3-24 of July 2014. The first part is a questionnaire survey carried out with 17 freight forwarder respondents. The goal is to determine from these representative companies the share of their shipments done by intermodal road-RoRo and the transport attributes that influenced their choice of mode. The second part of the field survey investigates the transport costs and travel times of both intermodal road-RoRo and inter-island shipping for selected origin-destinations. Since freight forwarders are hesitant to divulge their shipment cost breakdown and strategy, the second part of field survey involved the collection of data such as shipment tariff from shipping companies, ports fees, road toll fees, as well as travel times, loading cut-off time, average times in container yards, etc. pertinent to the selected origin-destination cases.

Part I of the questionnaire survey gathered the percentages of shipments from Manila to 9 destinations via (i) inter-island sea shipping from Manila port, (ii) intermodal road-RoRo transport and (iii) air transport. Air transport is included in the questionnaire as it is among the 3 modes generally used for freight transport in the country. The 9 selected destinations, with the approximate straight line distance to the farthest point of the island or location, were (1) anywhere within Luzon island (within 400 km), (2) Mindoro island (300 km), (3) Panay island (500 km), (4) Negros island (650 km), (5) Samar island (650 km), (6) Leyte island (700 km), (7) Cebu island (630 km), (8) Zamboanga (850 km), and (9) Davao (950 km). The destinations such as Mindoro, Panay and Negros islands can be reached intermodally through the Western Nautical Highway, while Samar and Leyte can be reached through the Eastern Nautical Highway. Respondents were also asked to specify the route taken especially for the case of intermodal road-RoRo transport. Characteristics of the shipment in terms of travel time, total transport cost incurred by the company and the break-down of cost (to include toll fee, shipping line tariff, port terminal fee, etc.) were obtained when permitted by the company.

The Part II of the questionnaire survey asked the respondents to rank from 1 to 5 (1 as highest) the top attributes that influence their choice of a specific mode over the other modes. A list of attributes was given. Since it is known that a percentage of cargoes is also transported through air, this mode is also considered in this part of the questionnaire. The result of this section gives us an insight on the factors that contribute to the freight forwarders preference of mode and the advantage of the use of mode over the others.

3.2 Questionnaire Survey Results

3.2.1 Respondents classification

Freight forwarder respondents can be further classified based on the services they cater or their service niche. For example, some companies offer both inter-island (specifically using container) and intermodal road- RoRo transport services while some only focus on one service. Some are dedicated truckers only of certain routes, and “co-loads” the shipment to other companies when they do not serve the specific area or when the shipment characteristic requires container transport. Such that, we were able to interview truckers catering only the Western Nautical Highway, covering the capital Manila to Negros island, and some providing transport only along the Eastern Nautical Highway up to Mindanao, etc.

Thus we show in Table 3 the classifications of the interviewed freight forwarders based on the services they provide. Five out of the 17 has their own intermodal trucking services. Eight companies have international cargo export and import as their main niche and only do pick-up and delivery within a certain reach. They seek the services of intermodal trucking services when necessary.

Table 3: Classification of companies interviewed for the survey

Characterization of Services Provided	Number of Companies
freight consolidation, domestic forwarding, intermodal trucking services	5
freight consolidation, domestic forwarding	2
international and domestic forwarding	8
parcel/freight forwarding services	2
TOTAL	17

3.2.2 Shipment share of modes

From Part I of the questionnaire survey, Figure 5 shows the cargo volume percentages transported by each mode for the 9 selected destinations. There are many cases when not all 9 destinations are serviced by a freight forwarder, thus we provided Table 4 to show the data sample size per destination.

Unlike in Europe, short-sea shipping, or sea transport along the coastline, is not popular in the Luzon main island. To ship to destinations outside the Manila, land transport is often used except for cases when the destination is another island in Luzon (i.e. Batanes) wherein air transport is an option because of the often unfavorable weather condition for sea transport. For the islands in the western seaboard (i.e. Mindoro, Panay and Negros), greater volume of cargoes are transported using intermodal road-RoRo transport than either inter-island sea transport or air transport. For Mindoro as destination, 74% is done by intermodal road-RoRo transport. This is not surprising since there currently is no liner vessel from Manila that serves Mindoro Island. The use of inter-island sea transport in this case is often for project cargoes, for example cargoes of a client building an industrial plant where the cargoes are bulky and oddly shaped that it is more suitable to transport them using tramper vessels. Moreover, interview with 3 freight forwarders with shipments to Negros Island revealed that more than 72% of their shipments are via intermodal road-RoRo transport.

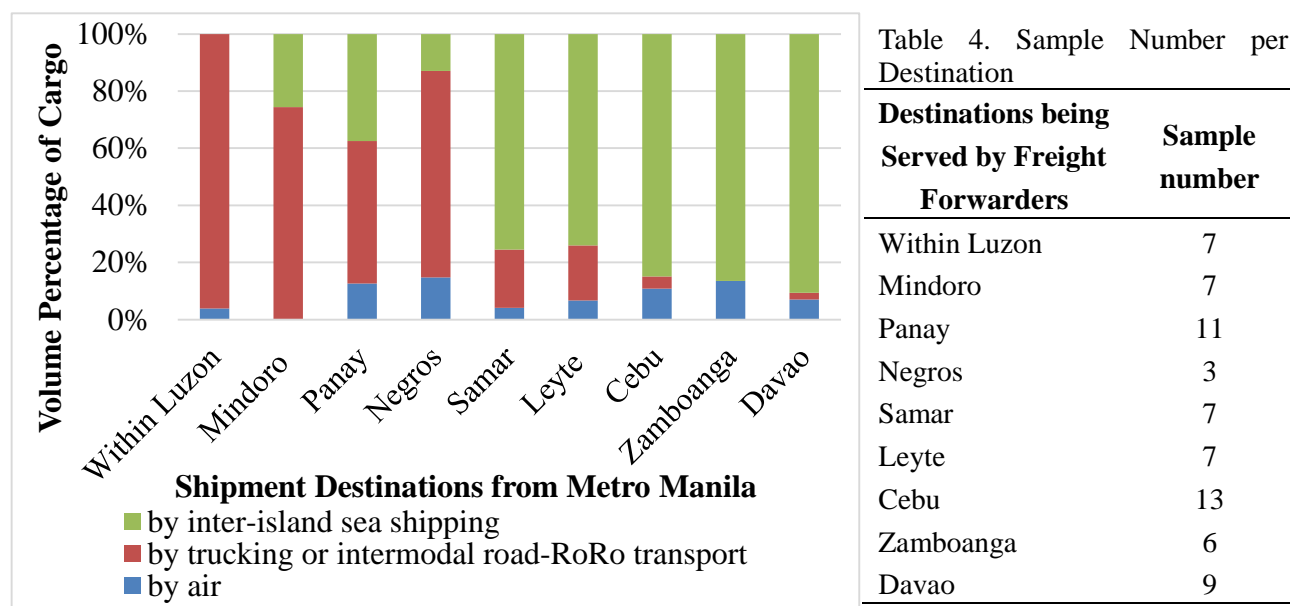


Figure 5. Percentages of cargo shipped by each mode type

Meanwhile, high percentage of cargoes shipped in destinations along the eastern seaboard (Samar and Leyte islands) are transported using inter-island sea transport, despite that only Tacloban and Ormoc ports have vessels coming from Manila. The choice of mode may also have been affected by the condition of road network from Allen to Calbayog City which has been categorized by travelers and bus operators as “bad” according to ADB (2010). Moreover, only around 4% of cargoes for Cebu Island are shipped intermodally, and even less for destinations in Mindanao Island (Davao and Zamboanga).

Also from the interview of 3 freight forwarders, intermodal transport and inter-island sea transport both carry every type of commodity from the following categories: (a) personal effects, (b) manufactured goods, (c) chemicals and related products, (d) mineral fuels, lubricants and related materials, (e) food and beverages, (f) crude materials, (g) machinery and transport equipments and (h) animal and vegetable oils, fats and waxes. Personal effects compose a substantial portion of commodities transported by intermodal transport, and these are often in the form of “balikbayan boxes” or boxes from overseas Filipino workers containing gifts and other effects intended for relatives in the Philippines.

3.2.3 Ranking of Important Attributes in the Choice of Mode

For each mode, the respondents were asked to rank the top 5 attributes (from a list of 18 attributes) which influenced them in choosing the particular mode (air, inter-island sea transport and intermodal road-RoRo transport). Tables 5 to 7 evaluate the ranking based on score, assigning scores 5, 4, 3, 2 and 1 to ranks 1, 2, 3, 4 and 5, respectively. The number of times the attribute is designated to a rank by the respondents is filled in the columns “B”, and these are multiplied to the corresponding score in column “A”. The sums of the AxB are the general weight of the attribute, which gives us the idea on the general ranking of attributes in the choice of mode. Note that not all of the freight forwarders

Table 5. Scores of influential attributes for the choice of Air Transport

Rank	Score (A)	Attributes																							
		1		2		3		=4		=4		5		6		=7		=7		=8		=8		9	
		Travel time		Reliability in terms of delay		Security in terms of cargo losses and damage		Availability of flights		Frequency of flights		Quality of service		Suitability to the cargo characteristics		Transport cost		Quality of airports and their facilities		Safety in terms of accidents		Delay at consolidation warehouse for LCL cargoes		Availability of tracking service	
		#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB
1	5	7	35	1	5	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	4	1	4	2	8	2	8	2	8	1	4	0	0	1	4	0	0	0	0	0	0	0	0	0	0
3	3	0	0	1	3	1	3	1	3	0	0	3	9	1	3	1	3	1	3	0	0	0	0	0	0
4	2	1	2	1	2	0	0	0	0	2	4	1	2	1	2	0	0	0	0	1	2	1	2	0	0
5	1	0	0	2	2	3	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Sum		9	41	7	20	6	14	5	13	4	13	4	11	3	9	1	3	1	3	1	2	1	2	1	1

Table 6. Scores of influential attributes for the choice of Inter-island Sea Transport

Rank	Score (A)	Attributes																											
		1		2		3		4		=5		=5		=5		6		=7		=7		8		=9		=9		10	
		Transport cost		Travel time		Suitability to the cargo characteristics		Frequency of vessels		Security in terms of cargo losses and damage		Quality of service		Reliability in terms of delay		Safety in terms of accidents		Quality of port and their facilities		Availability of vessels		Delay at consolidation warehouse for LCL cargoes		Delay in transaction at ports for dangerous goods		Availability of tracking service		Availability of facilities along the route	
		#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB
1	5	10	50	1	5	1	5	1	5	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	4	1	4	5	20	2	8	0	0	1	4	1	4	2	8	1	4	1	4	0	0	0	0	0	0	0	0	0	0
3	3	1	3	2	6	2	6	3	9	1	3	0	0	1	3	1	3	0	0	2	6	1	3	0	0	0	0	0	0
4	2	1	2	0	0	2	4	2	4	2	4	1	2	1	2	1	2	1	2	0	0	0	0	1	2	1	2	0	0
5	1	1	1	1	1	1	1	1	1	2	2	2	2	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1
Sum		14	60	9	32	8	24	7	19	6	13	5	13	4	13	3	9	3	7	3	7	1	3	1	2	1	2	1	1

Table 7. Scores of influential attributes for the choice of Intermodal Road-RoRo Transport

Rank	Score (A)	Attributes																																
		1		2		3		4		5		6		7		8		9		10		=11		=11		=11		=11		=12		=12		
		Travel time		Transport cost		Frequency of vessels		Reliability in terms of delay		Security in terms of cargo losses and damage		Capacity to deliver along the way		Availability of vessels		Availability of tracking service		Having sufficient cargo volume for the return trip		Safety in terms of accidents		Delay at consolidation warehouse for LCL cargoes		Delay in transaction at ports for dangerous goods		Quality of ports and their facilities		Quality of service		Quality of roads to be taken		Suitability to the cargo characteristics		
		#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	#(B)	AxB	
1	5	5	25	5	25	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	4	2	8	2	8	1	4	2	8	1	4	0	0	1	4	1	4	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	1	3	0	0	2	6	2	6	2	6	2	6	1	3	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2	3	6	1	2	1	2	0	0	1	2	1	2	0	0	0	0	1	2	0	0	1	2	1	2	1	2	0	0	0	0	0	0	0
5	1	0	0	1	1	2	2	0	0	1	1	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	1	
Sum		11	42	9	36	7	19	4	14	5	13	3	8	2	7	3	6	2	5	1	4	1	2	1	2	1	2	2	2	2	1	1	1	1

respondents conduct shipping by all 3 modes; only 9 respondents ship using air transport, 14 by inter-island sea transport and 11 by intermodal road-RoRo transport.

Air transport has the advantage of speed, thus the choice of this mode is predominantly because of the short *travel time* and *reliability in terms of delay*, as indicated in Table 5. Among the highest in weighted score are security in terms of cargo losses and damage, flights availability and frequency. Air shipment charges the fee for insurance, and airline companies have extensive coverage of domestic cities destinations several of which have multiple flights per day. It is not surprising that transport cost is not among the top in weighted score since the tradeoff of having fast speed is high cost.

For inter-island sea transport, *transport cost* is the most important attribute for the choice of mode with 71% of the respondents ranking it in top 1, and which also garnered the highest weighted score. *Travel time* only follows second in weighted score. *Suitability to the cargo characteristics* also has a high weighted score because for 20-footer container full container load (FCL) in container vessel, the maximum load allowed is 18 tons which is higher than the 13 tons limit commonly imposed for 10-wheeler FCL when loaded into short-distance RoRo vessels. This is despite that a 20-footer container has 33 cbm volume while a 10-wheeler truck has 45 cbm. RoRo vessels are relatively smaller and an instance of unbalanced weight of wheeled cargoes could make a vessel susceptible to overturning thus the strict weight limit. In effect, freight forwarders prefer to transport dense cargoes by container vessel because of the higher weight restriction.

For intermodal transport, *travel time* was ranked among the top 5 by all respondents (Table 7) and it has the top weighted score for the most important influential attribute. *Transport cost* only follows in second highest weighted score. *Frequency of vessels* comes third in the weighted score, higher than that in sea transport as more routes have more frequent vessel trips. *Capacity to deliver to destinations along the way* was also ranked among the top 5 by some respondents, an attribute unique only for this mode. Freight forwarder are enabled to fill one truckload faster since the load is composed of less than truckload (LTL) cargoes intended for different destinations along the route, thus also leading them to have more frequent trips. *Tracking of cargoes* is also easier for this mode since it often only involves contacting the truck driver or the truck's accompanying personnel using mobile messaging.

3.3 Transport costs and travel times comparison between intermodal Road-RoRo transport and inter-island sea shipping

Transport cost and travel time are ranked at top 1 and 2 as most important attributes that influence the choice for intermodal and inter-island sea transport. Thus, we gather transport costs and travel times data for transport originating from Manila to 7 destinations reachable by both modes. These destinations are Tacloban and Davao (reachable from Manila through the Eastern Nautical Highway route), Cebu (reachable intermodally through the Central Nautical Highway) and Iloilo, Bacolod, Dumaguete and Zamboanga City (reachable through Western Nautical Highway) as shown in Figure 6.

Figure 7 shows the average tariff for port-to-port transport of 10 footer and 20 footer container from Manila to the chosen destinations as gathered from shipping lines. These do not include port fees and cargo-handling fees. Table 8 shows the port-to-port tariff for 10-wheeler truck when transported through short-distance RoRo vessels of Montenegro Lines. The said shipping company caters for most of the links of the nautical highways. We do not consider the transport of 20-footer using long-distance intermodal road-RoRo transport because it is rarely used for this mode for the difficulty to maneuver a container trailer by

prime mover for long-distance land travel (such as distance from coast-to-coast of an island). This is only commonly used for intra-city transport such as transport from consignee door to the port. Ten-wheeler truck is the common mode unit for intermodal transport using by the respondents. Twenty-footer container, meanwhile, is the standard unit for the domestic container transport.



Figure 6. Locations of selected destinations

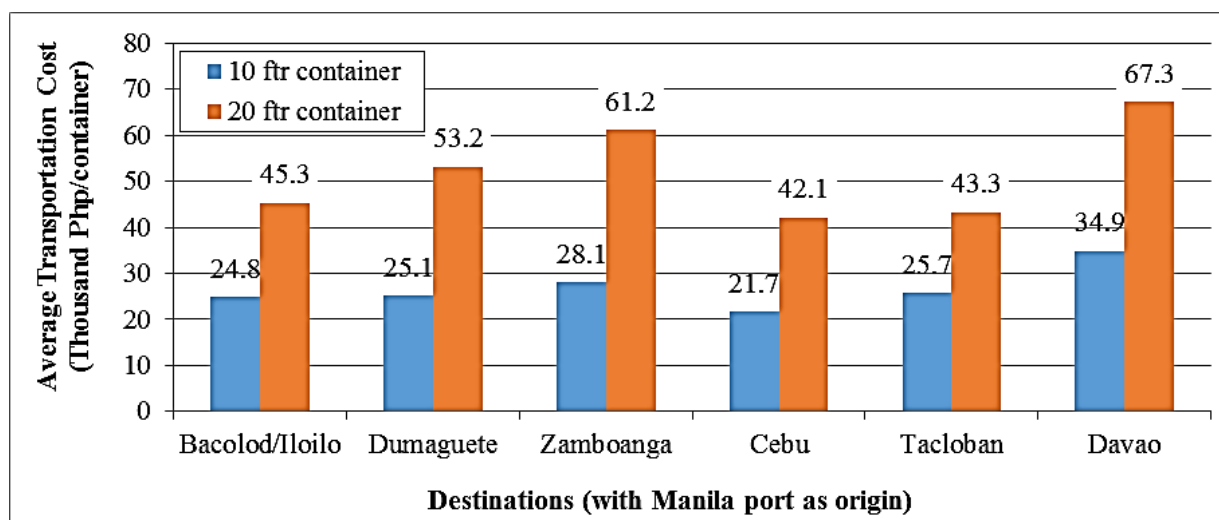


Figure 7. Average transport cost of 10 and 20 footer container by inter-island shipping (Source: interview, July 2014)

To transport from Manila to the destination city's center, other costs should be considered such as land trucking to-and-from ports, port fees and cargo handling fees. We estimate the total transport cost to include these other said costs (also gathered from interviews) to the tariffs in Figure 7 and Table 8. Table 9 shows the additional costs for both modes.

Table 8. Vessel Tariff for 10-wheeler truck

Route	Tariff for 10-wheeler truck (PhP) (as estimated to occupy 11.1-12 lane meters)
Batangas to Calapan	4,608.00
Roxas to Caticlan	8,832.00
Dumangas to Bacolod	3,072.00
Dumaguete to Dapitan	7,872.00
Matnog to Allen	2,880.00
San Ricardo to Lipata	5,040.00
Pilar to Masbate	7,776.00
Cataingan to Bogo	11,136.00

Source: Montenegro Shipping Lines website (September, 2014)

Table 9. Other incurred costs other than vessels tariffs for both inter-island sea transport and intermodal road-RoRo transport (source: interview with private sector)

Fees	Amount (PhP)
<i>For inter-island sea transport:</i>	
Trucking (Manila city center to Manila port)	5,950.00
Trucking from destination port to city center (average)	2,678.56
Arrastre/cargo-handling fee (average)	939.65
Wharfage	282.24
Document stamp	10.00
Weighing fee	80.00
<i>For intermodal transport of 10-wheeler truck:</i>	
Truck driver and crew wages and allowances	2,566/day
Truck fuel cost (1 liter of diesel per 2 km at 45Php per liter)	22.5/km
Toll fees	
Manila to Laguna South Luzon Expressway (SLEX)	496
Laguna to Batangas Southern Tagalog Arterial Road (STAR)	200
Port fees (Terminal fee, Weighing fee, PPA RoRo Terminal Fee)	611
Maintenance cost*	9.85/km

*Maintenance cost = (33 liters oil at 180Php/liter per 9,000km = 0.66Php/km)
+ (gear oil, automatic transmission fluid, brake fluid at total of 10,800Php per 30,000km=0.36Php/km)
+ (oil filter at 2,000Php/9,000km = 0.22Php/km) + (fuel filter at 1,800Php/9,000km = 0.20Php/km)
+ (air cleaner at 2,500Php/9000km = 0.28Php/km)
+ (tires at 19,000Php per tire x 10 tires / 55,000km = 3.09Php/km)
+ (RPS at 8,000Php/1,800km = 4.44Php/km)
+ (batteries at 6,500/piece x 2 pieces / 21,600km = 0.60Php/km)
= 9.85PhP/km

From the vessel tariffs and the other costs incurred, the total transport costs for both modes are estimated as shown in Table 10. Port-to-port distances and travel times data to aid the estimation, particularly for intermodal road-RoRo transport, were obtained from ADB (2010). The estimated total travel time range for intermodal transport mode indicates the shortest time when the truck does not have to wait in the port and the maximum time to include the maximum waiting time in the port in the case when the truck misses a vessel. This waiting time was made to equal to the maximum time interval between vessel arrivals.

Table 10. Estimates of total transport costs and travel times for inter-island shipping and intermodal road-RoRo transport

Destinations from Manila	20-Footer Container in Inter-island Sea Shipping		10-Wheeler Truck in Intermodal Road-RoRo Transport	
	Estimated Total Transport Cost	Port-to-Port Travel Time	Estimated Total Transport Cost	Estimated Total Travel Time
	(PhP)	(hours)	(PhP)	(hours)
Iloilo	55,278.08	20 – 24	32,610.90	16 – 22.5
Bacolod	55,278.08	20 – 68	38,859.90	17.5 – 28
Dumaguete	63,098.34	25 – 44	50,690.65	23.5 – 34
Zamboanga	71,119.97	37 – 72	70,579.69	30 – 48.5
Cebu	52,075.24	22 – 27	43,525.15	22 – 60
Tacloban	53,252.16	~30	32,707.85	18 – 24
Davao	77,210.48	~60	65,200.66	31.5 – 45.5

Meanwhile, the port-to-port travel times for inter-island transport are the ranges gathered from shipping lines as posted in their websites. The variations and ranges are due to different vessel routes and port of calls. Total travel times for door-to-door transport for this mode will be longer than the port-to-port travel times shown since inevitably it takes time to transport from door to port (vice-versa), for the time leeway for the vessel loading cut-off time, and time in storage in container yards. A conservative estimate of 6 hours, in total, could be spent for these activities.

From Table 10, the transport cost estimates for 10-wheeler truck unit in intermodal transport are lower than the 20-footer container in inter-island shipping. The range of total travel times of intermodal transport is also lower than the port-to-port travel times of inter-island shipping, except for Cebu destination which is due to less frequent RoRo trips from Cataingan, Masbate to Bogo, Cebu. Cebu being the second largest city in the Philippines has regular and frequent inter-island shipping vessels from Manila.

However, note that 10-wheeler truck and 20-footer container have different volumes and maximum payload limits, and interview with one of the largest freight forwarding company revealed that they take advantage of these characteristics to minimize cost. The maximum payload for 20-footer container (33 cbm) in container vessel is 18 tons and for 10-wheeler truck (45 cbm) is 13 tons. Thus, freight forwarders consolidate lighter cargoes with cargoes having shorter travel time demands and load them into 10-wheeler truck since intermodal transport arrives faster and the truck could carry bigger volume but lower weight. On the contrary, heavier cargoes are loaded into containers. Thus, if we calculate transport costs for both modes in per ton basis considering the maximum payload given, we can come up with the values in Table 11 for comparison.

Intermodal transport to destinations in Panay island (Iloilo) and Negros island (Bacolod and Dumaguete) has shorter travel time and lower or comparable transport cost, thus intermodal transport has higher volume share than the other modes for these destinations as

shown in Figure 5. Meanwhile, transport by container in inter-island shipping would cost less (per ton basis) for destinations such as Zamboanga, Cebu and Davao, which likely led to freight forwarders preferring this mode over the others as also indicated in Figure 5. Also, Cebu has more regular and frequent inter-island vessel trips from Manila. Transport costs by both modes for Tacloban do not differ significantly, and indirect transport using inter-island shipping could be done through Manila-Cebu and Cebu-Tacloban. Both routes have regular and frequent trips, with Tacloban being near Cebu. Thus, this could be the reason why inter-island shipping dominates for Leyte island where Tacloban is located. Moreover, the road from Allen to Calbayog City, an intermediate link to be taken for Manila-Tacloban intermodal transport is categorized as having “bad” condition (ADB, 2010); and from Table 8, the “quality of road” has a low score on what makes intermodal transport attractive.

Table 11. Cost per ton basis considering maximum payload of both modes

Destinations from Manila	Cost per Ton Basis (PhP)	
	20-Footer Container in Inter-island Sea Shipping	10-Wheeler Truck in Intermodal Road-RoRo Transport
Iloilo	3,071.00	2,508.53
Bacolod	3,071.00	2,989.22
Dumaguete	3,505.46	3,899.28
Zamboanga	3,951.11	5,429.21
Cebu	2,893.07	3,348.09
Tacloban	2,958.45	2,515.99
Davao	4,289.47	5,015.44

3.3 Summary: Mode choice condition

Transport cost and travel time are the top influential attributes for the choice for either of the two considered modes. Lower transport cost per unit container or per ton basis for relatively far destinations would lead freight forwarders to choose inter-island shipping over intermodal road-RoRo transport. This would be the case for transport to destinations such as Dumaguete, Zamboanga, Cebu and Davao which are more than 600 km from Manila. Intermodal road-RoRo transport costs lesser and have shorter travel time for destinations along the western seaboard such as Mindoro, Panay and Negros islands, thus more cargoes are transported thru this mode according to the survey. Also, the frequent RoRo trips along these destinations contribute to the preference for the intermodal mode. Frequent trips shorten the waiting time in ports and, consequently, lead to shorter travel times. On the other hand, inter-island shipping has daily regular trips to Cebu, adding to the preference for the said mode for this destination. Transport to Tacloban island is cheaper via intermodal road-RoRo but the choice for this mode could be discouraged by the bad condition of some roads.

4. CONCLUSION

The paper details the developments of intermodal road-RoRo transport in the Philippines and provides an overview of its current state in the country. RoRo vessels have been in use in the country since the 1970s. But increase use of RoRo transport as part of the intermodal transport system started when policies were enacted in 2003. The policies established the Road-RoRo Terminal System (RRTS), and provided policy changes that promote intermodal operations. The developments increased RoRo operations and heightened the competition in

the shipping industry pushing some companies to remove or reduce inter-island shipping operations in some regions and venture into RoRo vessel operations. Positive impacts were realized since the operation of RRTS, namely, economic growth and area development in towns with RoRo ports, transport efficiency due to more frequent trips, opening of new markets especially for agricultural products, and enhancement of tourism.

The paper contributes knowledge on the choice basis for intermodal road-RoRo transport over inter-island container transport and air transport for an archipelagic topology such as the Philippines, noting that this intermodal transport is distinct in that the vehicle traverses several land and sea legs in one shipment. The top five influential attributes for the choice of the intermodal mode tally with the findings of D'Este and Meyrick (1992), but relative importance is in the order of travel time, cost, frequency of vessels, reliability of delay and security in terms of losses and damages. The frequent trips of RoRo vessels in most legs compared to the inter-island shipping vessels give intermodal transport the advantage of shorter lead times leading to shorter travel times. Thus, from the survey, *travel time*, followed by *transport cost*, is the top attribute that influence freight forwarder on choosing intermodal transport. The result also indicates that even when transport using intermodal transport to a destination is cheaper, the choice for the mode could be countered by the poor condition of roads.

The results of the surveys conducted offer only an overview of the current situation of intermodal road-RoRo transport and the competition with inter-island shipping. The survey is limited in the number and classification of respondents. Since it is difficult to obtain actual transport costs information from freight forwarders, it is suggested to also interview frequent shippers such as individuals, farmers or companies of consumer goods. Moreover, for the transport costs comparison, the paper is limited in only considering 20-footer container and 10-footer truck for inter-island shipping and intermodal road-RoRo transport, respectively. Other transport units and vehicles are suggested to be looked upon in the next studies. For further study, a more comprehensive stated preference survey is suggested in order to develop a mode choice model for the alternative modes present in the Philippines; and thus, also be able to suggest concrete improvements for the freight transport operations of the country.

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