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Virtual Container Yard: Assessing the Perceived Impact of Legal Implications to Container Carriers

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***Abstract*—**Virtual Container Yard (VCY) is a modern concept that helps to reduce the empty container repositioning cost of carriers. The concept of VCY is based on container interchange between shipping lines. Although this mechanism has been theoretically accepted by the shipping community as a feasible solution, it has not yet achieved the necessary momentum among container shipping lines (CSL). This paper investigates whether there is any legal influence on this industry myopia about the VCY. It is believed that this is the first publication that focuses on the legal aspects of container exchange between carriers. Not much literature on this subject is available. This study establishes with statistical evidence that there is a phobia prevailing in the shipping industry that exchanging containers with other carriers may lead to various legal implications. The complexity of exchange is two faceted. CSLs assume that offering a container to another carrier (obviously, a competitor in terms of commercial context) or using a container offered by another carrier may lead to undue legal implications. This research reveals that this fear is reflected through four types of perceived components, namely: shipping associate; warehouse associate; network associate; and trading associate. These components carry eighteen subcomponents that comprehensively cover the entire process of a container shipment. The statistical explanation has been supported through regression analysis; INCO terms were used to illustrate the shipping process.

***Keywords*—**Container, legal, shipping, virtual

I. Introduction

VRITUAL container yard has its fundamental concept rooted in collaboration between shipping lines. It is believed that more than 90% of world trade is transported by sea. Globalization has increased the need for the interconnectedness for the respective countries to cross their borders [1]. According to the International Maritime Organization (IMO), in 2017, containerized trade accounted for 17% of total seaborne trade [2]. Shipping is a derived demand [3] of the international trade in economic terms [4]. The VCY is a modern Container Inventory Management (CIM) system. It has been introduced to minimize the cost of empty container repositioning through exchange of containers between CSL.

Logistics and supply chain cost reduction became the focus for companies today [5]. The United Nations Conference on Trade and Development (UNCTAD) estimates that in 2017, 752 million twenty-foot equivalent units (TEUs) were moved at container ports worldwide. Container shipping plays a significant role in the global supply chain [6].

The VCY concept is fundamentally rooted in container exchange (CE) between carriers. Since carriers usually experience variations in container availability, it is possible to exchange them economically rather than re-position empty containers. Repositioning of empty containers becomes necessary when the cargo is de-stuffed and there is lack of cargo in the same location to stuff them again for onward carriage. Therefore, VCY is a solution to the global Container Inventory Imbalance (CII) that ultimately leads to reduction of transport and logistics costs in international trading. The demand for shipping has direct impact to supply chains [7]. Carriers have been exchanging ships' space (slots) for more than two decades in the same manner. Slots and containers complement each other. Unlike in break bulk, tanker, or bulk ships, carriage in a container ship cannot be affected without both components (i.e. slots and containers) being simultaneously available at a given location, and in equal quantities. Carriers formed various alliances and consortia in order to facilitate effective and efficient collaboration between them under mutually agreed terms and conditions. Identifying the similarities between slots and containers, some carriers also incorporated CE in alliance/consortia agreements. However, CE has so far not achieved popularity like the slot exchange. CII shows an increase in trend along with increased volumes of global trading. This additional transportation cost in turn leads to higher prices of consumer goods [8]. Therefore, the cost of empty container re-positioning has also continued to increase. However, carriers are reluctant to exchange containers citing various reasons. If the transport cost brought down the price of associated goods and services, it also may reduce proportionately in a competitive market [9]. As clarified in the exploratory study, there are four major justifications for this scenario according to CSL. Firstly, the carriers perceive that there is no opportunity to exchange due to the derived demand characteristics in shipping. Therefore, they do not wish to invest their resources in perusing this concept any further, and commercialization of VCY is thus a challenge. Shipping is a derived demand of international trading. Therefore, the carrier actions, and their reactions are usually impacted on supply chains [10]. Secondly, carriers are reluctant to exchange containers with competitors due to obvious marketing reasons. A similar resistance was also evident during the initial stages of implementing slot exchange

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between alliance partners due to branding conflicts. Thirdly, carriers foresee various legal implications in using containers belonging to other carriers. Finally, carriers simply pass the additional costs of Empty Container Reposition (ECR) to customers as part of the freight charges, or as a surcharge. Therefore, carriers have not been pressured to find a solution for this. However, these costs are finally borne by the consumers of the cargo being transported, thus creating a social problem. IMO is the global authority that regulates preventing loss of containers.

International trade refers to the exchange of capital, goods, and services across international borders or territories [11]. Most importantly, now there is global code of practice for the handling and packing of cargo transport units for transportation by sea and land [1]. The efficiency of logistics largely depends on government services, investments, and policies. This is purely due to fact that global supply chains are so varied and complex [3]. The CII generates various costs and has a direct impact to the shipping lines and their agents [1]. This paper discusses the legal implications generated by carriers' concerns regarding this matter. Evaluation of the pros and cons of VCY in the legal context is a timely initiative simply because statistics show that there are opportunities to exchange containers. The cost of repositioning of empty containers represents a considerable portion of container fleet management expenses [12].

If the benefits of CE supersede its intended marketing disadvantages, carriers may peruse this solution. In addition to the additional costs to consumers, the ECR generates a serious environmental hazard. There is a tremendous pressure on reducing logistics cost and carbon footprint [2]. Thus, there is social responsibility imposed on carriers to mitigate the burden on the public.

The main objective of the research is to identify the legal implications that influence the concept of the Container Yard.

A. The Container Shipment Process

Generally, land transportation plays a major role in efficient maritime transportation [13]. Since implementation of VCY is heavily influenced by the legal aspects, it is necessary to evaluate each point in the supply chain process that involves containers borrowed from another carrier. Fig. 1 illustrates the activities that take place in this process.

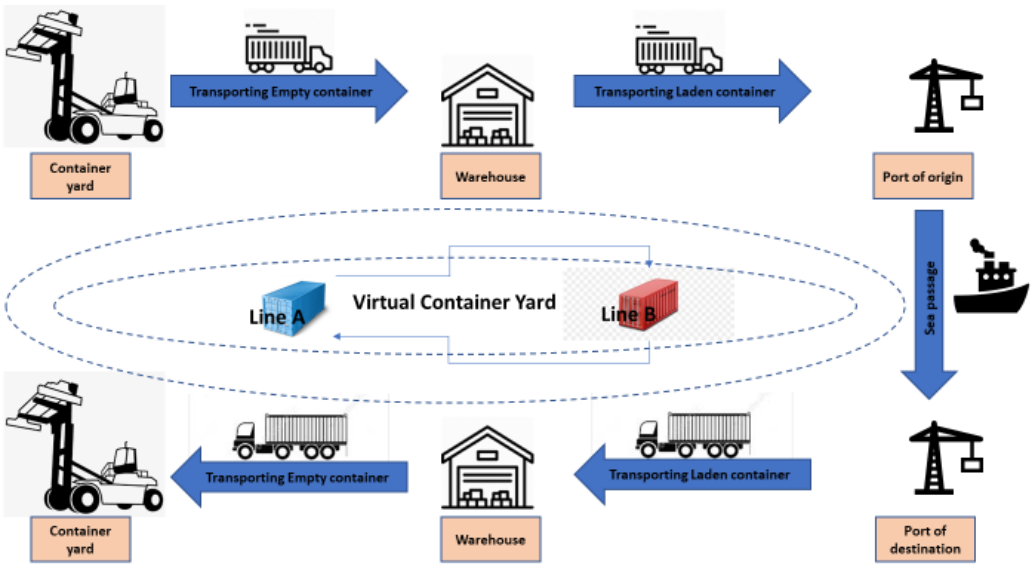


Fig. 1 Activities of a container in the shipping process

VCY is a container database that comprises details of container inventories of all participating shipping lines. Carriers face some distinctive problems in managing the container inventory. The containers are distinctive from other inventories because both the demand and supply components of shipping containers are strongly influenced by the external trading patterns of respective countries. Therefore, the VCY should be operated as on-line global platform which essentially contains actual and forecasted data. The successful collaboration between carriers leads to exchanging of containers in a virtual platform. In other words, it is the climax of an effective CE mechanism between carriers that synchronize multiple CIM systems in a virtual environment. The containerized shipping industry is characterized by oligopoly [3]. Therefore, it has been possible that carriers usually incorporate empty reposition costs in freight charges. Some carriers, such as Maersk Line, add a separate component called Empty Reposition Surcharge (ERS). This can be considered the fourth reason for not exchanging containers. Since the empty reposition cost can be reimbursed from the customers, the carriers will not bother to find a solution for this problem.

B. CE

Collaboration is not a new strategy to the container shipping industry [14].

Container carriers exchange slots (shipping space of a cellular ship) to enjoy the advantage of their economies of scale. At the initial stages of slot exchange there were some negative concerns about its perceived marketing disadvantages. A well planned, realistically and accurately forecasted, effective managed container flow ensures the supply and delivery of containerized materials and goods in time, in a cost-efficient way. Shipping, as a business, derives from the demand for exports and imports of goods; and as such, the container inventory follows a similar pattern. Inequality of import and export volumes leads to a shortage or excess of containers in the relevant country. The resultant CII is a global issue and the biggest challenge in CIM. In this paper, a solution to this problem is proposed through CE between carriers; it also evaluates the possibilities of implementing the concept in the real business environment. There is a major lack of transparency regarding container movements and inventory in the global container network which causes substantial inefficiency in the entire supply chain. This invariably leads to high costs in transportation, sourcing, materials planning and in administering containers as well, due to inadequate availability of containers at low service quality. It is reported in Shipping Watch [15] that the imbalance in global markets forces Maersk Line to sail around with 4 million empty containers a year, and there is no immediate solution to the problem.

Unlike in bulk, break-bulk or tanker shipping sectors, ships' space (slots) and containers are the basic service components in container liner shipping. They supplement each other. A carrier cannot transport cargo unless both components are available simultaneously at a given place, in the right quantities, at a specific time. There is a strong argument in the contemporary shipping milieu that supports because carriers exchange slots to gain the advantage of economies of scale to their fleets. Given the conceptual similarities in the utility of slots and containers, many leading carriers have included provisions to exchange containers in their alliance agreements. There has been some ad-hoc interchange of containers between carriers when their exporters erroneously stuffed cargo in another shipping lines' container [15]. However, it is paradoxical that the exchange has not yet been effective as a trade practice with respect to containers.

C. Evaluating the Opportunities for VCY

Due to the nature of liner shipping industry, the supply and demand is very difficult to match [4]. The container statistics in Sri Lanka in recent years reveals that approximately 46% of exports are empty containers [17]. This is attributed to the evacuation of excess containers. Interestingly, the imports also comprise 10% of empty containers. According to these statistics, the fundamental prerequisites of exchange have been fulfilled suggesting that the exchange would have been possible as the carriers have experienced both shortage and excess scenarios. However, carriers do not view this situation as supportive of VCY. They counter these conflicting statistics by citing two reasons. Firstly, carriers do not face the above excess and deficit scenarios simultaneously; it is only a seasonal phenomenon. Accordingly, at a given time all the carriers are either in excess or deficit mode with no opportunity to exchange. Secondly, there are different sizes and types of containers. Therefore, while certain types/sizes are in excess, other types/sizes that are in demand by exporters can be in deficit. The key hypothesis of the paper suggests that the container movements of individual carriers might not necessarily follow precisely the same pattern and challenges as the industry perception. Therefore, the monthly individual container statistics of carriers in Sri Lanka in recent years should be investigated. The paradigm of interconnectedness continues to hold command in today's global community [16].

The carriers are faced with a dilemma to strike a balance between the demand and supply [5]. The container imbalance in a specific location is equal to the sum of excess and deficit containers. Carriers with excess containers should evacuate them promptly (reposition out) while others need to import empty containers (reposition in) to bridge the deficit gap against the exporters' demands. In other words, irrespective of whether it is excess or deficit, there is demand for empty reposition in both situations. This is the outcome of the present 'work alone' scenario. This paper proposes a paradigm shift to 'collaboration'. The ultimate objective of VCY is to minimize the total imbalance by setting off importation of empty containers (reposition in) against exportation of empty containers (reposition out) or vice versa. From the above-mentioned statistics, it appears that the imbalance could have been reduced to 3259 through exchange. In this example, a specific type/size is considered, namely, 40 GP containers, thus challenging the myopic view of carriers with respect to container types/sizes. CE involves many decision parameters, thus information communication technology (ICT) could bridge this industry gap and facilitate effective and economical decision to exchange containers [17].

D. Research Objectives and Significance

The shipping industry has not made a notable attempt to evaluate the benefits of CE because the carriers in the sector believe that there is no opportunity for CE, as the intrinsic trade imbalance is commonly applicable to all carriers [2]. Most of the literature has thus far focused on minimizing the 'cost' of empty reposition which is a kind of reactive measure. In contrast, VCY offers a solution of a 'proactive' nature as it can be and should be synchronized with carriers' import container forecast and the export container forecast of each port. The core issue that prevails in the industry is to find a mechanism to decrease the cost incurred on CII thus better utilization of resources [4]. Accordingly, this collaboration may primarily reduce the reposition of the number of empty containers. Although the industry fully supports VCY as a conceptual model, the key stakeholders perceive many legal implications. This is the main impediment that slows down the commercialization of this model. This paper is expected to expose the doubts of the industry stakeholders and thus provide a significant contribution to the container shipping industry.

II. Literature Review

The shipping container includes open top, flat rack, platform, trailer, transportable tank, pallet or any other similar item. The purpose of this unit is mainly to consolidate the goods. "Goods" means the whole or any part of the cargo and any packaging accepted from the Shipper and includes any container not supplied by or on behalf of the Carrier [2]. The Cambridge dictionary states goods, but not passengers, that are carried from one place to another, by ship, aircraft, train, or truck, or the system of transporting these goods are called "freight" [6]. Containerization has its own problems; despite the huge benefits it provides [7]. A major challenge revolving around container shipping is the repositioning of empty reusable containers [18] that cost $16 billion [8]. The fundamental reason for empty repositioning is the trade imbalance [9] and disparity in worldwide trade distribution, [19] or imbalances in moving cargo [10]. The imbalanced status of containers causes ECR [20] and is non-revenue generating, expensive and an undesirable exercise [11].

There are three main sources of container inventory: 1. The LDN imports; 2. MTY imports (or manufactured newly in the same port); and 3. Leased containers. Since the containers are a part carriers' branding strategy, CSL prefer to use their own containers as much as possible rather than using leased units [1]. The amount of carrier owned equipment may vary depending on a carrier's business strategy. It is usually between 50% and 90%. The smaller and regional CSL used to rely only on rented boxes [12].

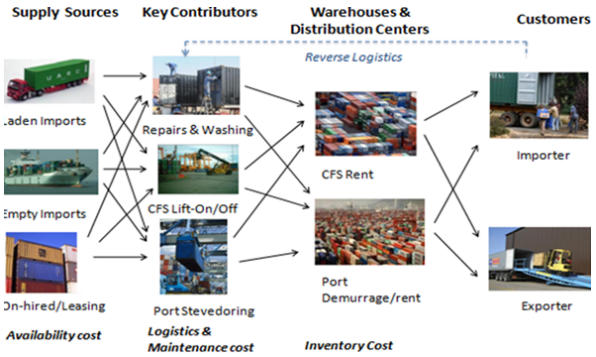


Fig. 2 Container supply chain of shipping lines [1]

As explained in the Maersk website, "carriage" means the whole or any part of the carriage, loading, unloading, handling and any and all other services whatsoever undertaken by the Carrier in relation to the goods [21]. Governments have a greater responsibility such as building infrastructure, developing a regulatory regime for transport services on hand. On the other hand, designing and implementing efficient customs clearance procedures is another bottleneck that they should play a key role [22].

The nature of the liner shipping industry means that the supply and demand is very difficult to match [13]. There are certain industry practices that help safeguard the interests of trade and some carriers may adhere to them while others do not. Since there is no guarantee that all players in a common container pool will follow such practices, carriers may be reluctant to share containers [14]. Fig. 3 illustrates the movements of containers in a hypothetical VCY. This is the basic operational model that only considers four shipping lines namely, A, B, C, and D; operative in three ports, namely, u, v and w. The 12 boxes explain the container interchange between the shipping lines for four weeks namely, t1, t2, t3, and t4. For example, during week 1, at port u, carrier B has a shortage of 190 containers. Carriers, A, C, and D have 200, 60, and 200 excess containers, respectively. B has the option of receiving containers from either A, C, or D. It may, for instance, be 190 from A or D; otherwise, 60 from C and 130 from D, if receiving most containers from C is more beneficial than getting all from D. In this example, A gives 100 containers to B. After receiving them, B loads their exporters' cargo in them and transports them to destination v. The exchange does not end there because the benefits that the offeror derives by exchanging are not always equal to the benefits that the offeree receives. Therefore, B should now give containers in some ports where A is in deficit. In the third week, A suffers a shortage of 150 containers in port u and B reciprocates by giving to A, 100 containers there. By contrast, it is instructive to observe the inventory position at v in the third week. A and C are both in deficit status with -150 and -230, respectively. B and D have excess containers, 100 to be precise. Once the exchange in the first port is affected, the major variable that impacts the next stage in the process is the number of days that the offeree would want to keep the containers in its custody. This depends on the destination to which the offeree's customers have booked their cargo. This single case explains the various complicated scenarios that could be generated in a full-fledged VCY.

TABLE I
Operating the VCY to Provide Equal Gains to All Associated Carriers

Exchange		Container type	Number of units	Port movement		Number of transit days	Evaluation of outcome
From	To			From	To		Gain (TEUs X Days)
B	A	40	25	x	w	20	1000
A	B	20	50	x	w	20	1000
A	C	20	10	x	w	20	200
C	A	20	25	y	w	8	200
B	C	40	10	y	v	10	200
C	B	20	20	y	v	10	200

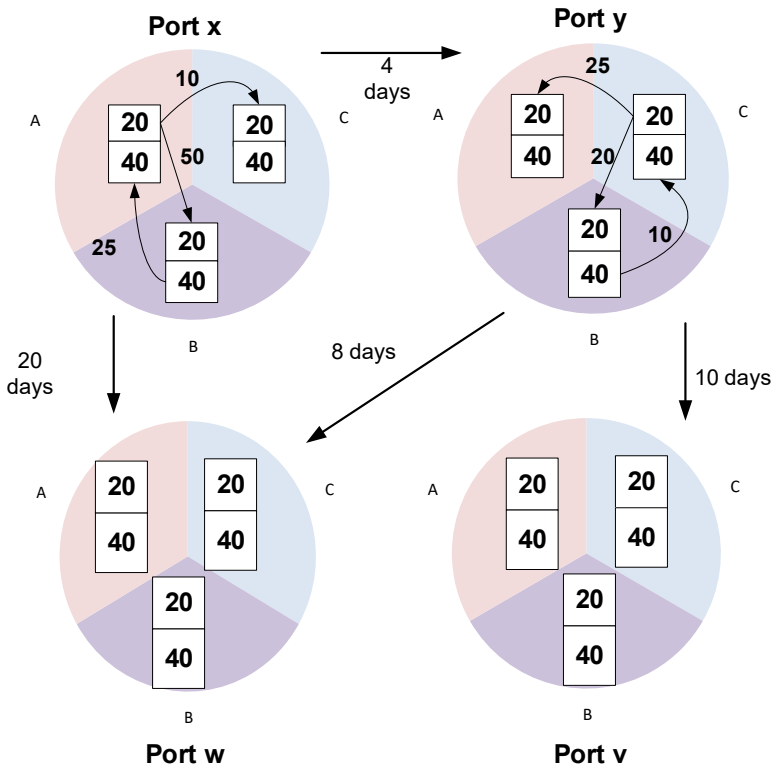


Fig. 3 Dynamic Planning model of VCY [15]

TABLE II
LEGAL IMPLICATION AS PERCEIVED BY THE CSL

Code	Scenario	Background
LGLOBL	CSLs do not exchange containers as there is no market practice and the legal obligations are not known about CE.	There is an industry forbearance for collaboration between competitors. This is common in an oligopoly market. The containerized shipping industry is characterized by increased concentration. Some trade lanes may be characterized as a loose oligopoly; others as a tight oligopoly [23].
OFFROR	CSLs do not exchange containers mainly due to possible legal problems that may arise from other carriers using their containers.	The approval evidenced by the Safety Approval Plate granted by one State Party to the International Convention for Safe Containers [24] should be recognized by other State Parties. This principle of reciprocal acceptance of approved containers constitutes the cornerstone of the CSC 1972. Once approved and plated, containers are expected to move in international transport with the minimum of safety control formalities. The subsequent maintenance of a container approved for safety is the responsibility of the owner, who is required to have the container periodically examined.
OFFRFE	CSLs do not exchange containers mainly due to possible legal problems that may arise from us using containers that belong to other carriers.	CSC 1972 sets out procedures whereby containers used in international transport must be approved for safety by the Administration of a State Party or by an organization acting on its behalf. The Administration, or an organization authorized by it, will then authorize the manufacturer to affix a Safety Approval Plate containing the relevant technical data onto approved containers [2].
CFSEWH	CSLs perceive that legal implications occur during inland carriage of empty containers from CFS to the respective exporter's premises at origin.	CSC 1972 has two goals: one is to maintain a high level of safety of human life in the transport and handling of containers by providing generally acceptable test procedures and related strength requirements which have proven adequate over the years; the other is to facilitate the international transport of containers by providing uniform international safety regulations, equally applicable to all modes of surface transport. In this way, proliferation of divergent national safety regulations can be avoided [2].
EXPTWH	CSLs perceive that there are legal implications during the storage of empty containers at the respective exporter's premises	Usually the exporters use the containers belonging to the respective shipping lines and there is no increased risk at this point, except when the container belongs to a party that is totally external to this direct business relationship.
EWHSTF	CSLs perceive that there are legal implications while the cargo stuffing is being done at exporter's premises.	According to IMO [2], the enforcement of the SOLAS requirements regarding the verified gross mass of packed containers falls within the competence of State Parties to the International Convention for the Safety of Life at Sea (SOLAS) and is their responsibility. Acting as port States, they should verify compliance with these SOLAS requirements. Any incidence of non-compliance with the SOLAS requirements should be enforceable under national legislation.
EWHPRT	CSLs perceive that there could be various legal implications during inland carriage of laden containers from exporter's premises to port of origin.	CSC 1972 was amended in 1981 to provide transitional arrangements for plating of existing containers (which had to be completed by 1 January 1985) and for the marking of the date of the container's next examination by 1 January 1987. It was again amended in 1983 to extend the interval between re-examinations to 30 months and to permit a choice of container re-examination procedures between the original periodic examination scheme or a new approved continuous examination program. In 1991, amendments were adopted to annex I to prevent containers being marked with misleading maximum gross weight information, to ensure removal of the Safety Approval Plate when void for any reason and

Code	Scenario	Background
		to provide for the approval of modified containers. Amendments to annex II clarified certain test provisions. The 1991 amendments entered into force on 1 January 1993 [2].
EXPCUS	CSLs perceive that there are potential legal implications while cargo is being cleared for exports by Customs at origin.	The International Maritime Dangerous Goods (IMDG) Code is a mandatory international code for the maritime transport of dangerous goods in packaged form, adopted to enhance and harmonize the safe carriage of dangerous goods and to prevent pollution of the environment. The Code sets out in detail the requirements applicable to each individual substance, material or article, covering matters such as packing, container traffic and stowage, with particular reference to the segregation of incompatible substances [2].
PRTLDG	CSLs perceive that there are legal implications while laden containers are waiting to be loaded on board.	SOLAS includes, in its chapter VI on carriage of cargoes, requirements for stowage and securing of cargo or cargo units (such as containers). CSC 1972 provides test procedures and related strength requirements for containers [2].
LDDONB	CSLs perceive that there are many legal implications while laden containers are being loaded on board.	According to [2], the International Organization for Standardization (ISO) has revised relevant ISO standards (ISO 1161: Series 1 freight containers – Corner fittings – Specifications; and ISO 3874:2017: Series 1 freight containers – Handling and securing) in order to incorporate the most recent advances in container handling and securing equipment, taking account of the latest generation of container ships with design capacity in excess of 18,000 TEU and including design and strength characteristics for automatic twist locks. IMO has also adopted the Code of Safe Practice for Cargo Stowage and Securing (CSS Code).
ONBDST	CSLs perceive that legal implications occur while laden containers are *en route* to their destination.	The Convention on Limitation of Liability for Maritime Claims (LLMC), 1976 together with its 1996 Protocol limits the liability for claims in respect of, *inter alia*, removal of the cargo or of anything that has been on board a ship. The International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), 1996 (and its 2010 Protocol), when in force, will establish a two-a tier system for compensation to be paid in the event of accidents at sea involving hazardous and noxious substances such as chemicals. It covers not only pollution damage but also the risks of fire and explosion, and preventive measures regarding these risks; and it covers loss of life or personal injury as well as loss of or damage to property [2].
TRNSHP	CSLs perceive that there are potential legal implications while laden containers are being transhipped.	Usually, containers are handled either in the loading port or discharge port (either as transhipment or final destination) except on rare occasions such as re-stowage. However, if the containers are transhipped in one or more ports the probability of associated legal implications would be greater.
PRTDIS	CSLs perceive that there are potential legal implications while laden containers are being discharged at destination.	Amendments to the CSC 1972 adopted by resolution MSC.310(88) entered into force on 1 January 2012 and include new specifications regarding Safety Approval Plates, describing the validity of, and elements to be included in, approved examination programmes; a new test for containers being approved for operation with one door removed; and the addition of a new annex III on control and verification. Annex III provides specific control measures for authorized officers to assess the integrity of structurally sensitive components of containers and to decide whether a container is safe to continue in transportation or whether it should be stopped until remedial action has been taken [2].
IMPCUS	CSLs perceive that there are potential legal implications while laden containers are being cleared from customs and other border management agencies at destination.	In the loading port, the exporter has more control over facilitating a smooth customs and border management process. However, when the shipment is at the destination every claim is limited to some documentary evidence send by the exporter. This reality leads shipping lines to perceive the associated risks differently.
PRTIWH	CSLs perceive that there are potential legal implications during inland carriage of laden containers from destination port to the respective importer's premises.	The technical annexes to CSC 1972 specifically require that the container should be subjected to various tests, which represent a combination of safety requirements of both the inland and maritime modes of transport. Flexibility is incorporated into the Convention by the provision of simplified amendment procedures for the technical annexes [2].
IMPTWH	CSLs perceive that there are potential legal implications during the storage of laden containers at the respective importer's premises.	There is no clarity of how the insurance policies are going to be applicable in the VCY; whether the offeror or the offeree must do the full insurance, or whether risk is to be independently insured. This is yet to be established. In such circumstances the shipping lines may perceive that their containers are not safe in the warehouse of an importer of another shipping line.
IWHDIS	CSLs perceive that there are potential legal implications during the unloading of cargo at the respective premises of the consignee such as damage to containers, etc.	The amendments to the CSC 1972 adopted by resolution MSC.355(92) entered into force on 1 July 2014 and include new definitions at the beginning of annexes I and II, along with consequential amendments to ensure uniform usage of terminology throughout CSC 1972; amendments to align all physical dimensions and units to the S.I. system; the introduction of a transitional period for marking containers with restricted stacking capacity; and the inclusion in annex III of the list of deficiencies which do not require an immediate out-of-service decision by the control officer but do require additional safety measures to enable safe ongoing transport. These new amendments incorporate many elements of the 1993 amendments and although they are not identical to them, in practice they have the same effect [2].
IWHCFS	CSLs perceive that there are potential legal implications during inland carriage of empty containers from importer's premises to CFS at the destination.	Usually this passage consists of either road or rail transport. The traffic regulations are different from country to country. Therefore, a shipping agent in one country may perceive more exposure of their containers during transportation in another country.

CE between carriers may in general lead to various legal implications. Therefore, it is vital to consider all the sequences of the container shipping process when evaluating the legal implications of the VCY. This study identifies 18 key decisive points that shipping lines perceive could result in exposure to legal consequences. These scenarios are explained in Table II, prepared by one of the authors Dr. Lalith Edirisinghe.

Trade imbalance leads to global container imbalance and finally results in frequent container repositioning. Efficient and effective management of empty containers [25] and ECR [26] are important issues in the liner shipping industry. This paper explains the need for a paradigm shift from the present 'work alone' container management model to a new model in which carriers may 'collaborate' for mutual interests. Reference [27] suggests that each sector will benefit from the collaboration, but it will not be at the same rate or in equal

portions to the participants. Cooperation between competitors includes both the elements of cooperation and competition [28] and irrespective of greatest, carriers may want to avoid collaboration among competing firms in general. The main purpose of the collaboration is to attain competitive advantages [29], and while it provides a valuable business model and enhanced performance [30], it may lead to interdependence between companies when they compete against each other in the marketplace [31].

The maximum 'utilization' of containers is achieved only if containers are always on the move with freighted cargo between the exporters and consignees. On the other hand, containers should provide return on investment and if they are just stored unmoved it adds costs. Containers may move with freight within the shortest possible time, destuff cargo, revert empty container to the next exporter to reuse for another shipment with shortest turnaround time. However, quite contradictorily, as cited in [32], containers remain idle for about half of their lifetime, as they are either being maintained, repaired or in storage or transit. The increasing complexity of transportation and manufacturing networks poses huge challenges for CIM; thus, effective and efficient CIM methods are an essential factor. In dealing with empty containers, the handling of uncertainty, particularly of demand, can be a major problem [33]. It is not necessary to allocate high capital expenditures to operate an effective container supply chain if the carriers have a clear focus effective on container management activity. However, it is easier said than done, given the complex and distinctive nature of container inventory. The consumption of the inventory takes place while those are on the move. The box-to-slot ratio stands at 1.99 [34] and this includes every container not only on ships, but sitting in ports, on trucks, at factories and elsewhere [35]. Despite rapid technological advancements in the maritime sector, CIM systems are often carried out independently and are neither standardized nor integrated to reap the advantages of economies of scale. The core issue in the industry is the absence of an effective mechanism to mitigate the negative impacts of container imbalances for the better utilization of resources [36].

The absence of collaboration is mainly due to carriers' uncertainty about the feasibility of container interchange and the success of VCP mainly depends on the ability of overcoming this psychological barrier [37]. Organizations constantly strive to enhance their performance through collaborative supply chain management techniques [38]. Shipping lines, realizing the need for inter-firm collaboration, commenced sharing slots with competitors primarily to minimize the negative outcome of shipping space imbalance caused by the ultra large ships. This scenario encouraged carriers to collaborate and form alliances/consortia. Successful alliance collaborations create new value that can come from sharing of resources, gaining market entry and/or critical mass in a particular marketplace, or enhancing efficiency and effectiveness [39]. However, some of these factors were not very market-friendly for some carriers. The agents of the carriers initially objected to slot sharing as they perceived many marketing challenges, particularly those dominating in certain trade lanes. Certain agreements have even identified equipment interchange as another area of collaboration but so far it has not been implemented. However, the shipping alliances gradually extended the collaborations to other areas such as, service rationalization, operating expense sharing, and joint service contracts. Reference [40] provides a summary of alliance agreements that existed in the Transpacific Trade from 2006 through to 2010. Accordingly, 13 mega carriers that represent 42% of world container trade have had alliance agreements that facilitated equipment interchange, although there is no evidence of CE among these carriers.

The most concerning factor when two shipping lines exchange containers is whether they will be returned safely. This concern may be due to the associated risk of international transportation business particularly when the inventory is controlled by another party. According to the World Shipping Council (WSC), there were 568 containers, on average, (not counting catastrophic events) lost at sea each year for the combined 9-year period from 2008 to 2016, and 1,582 containers were lost at sea each year including catastrophic events. On average, 64% of containers lost during this period were attributable to a catastrophic event [2].

III. Methods

Legal research methodology is generally of the qualitative variety as distinguished from quantitative or empirical. It consists of three types, namely, the doctrinal or dogmatic method which relies heavily on legal theory and is predominant, the comparative analysis type which involves comparison of legal phenomena, and the historical type which focuses on how law has changed by evolution. However, where the subject matter is inter-disciplinary in scope, as in the present case, empirical methodology based on analysis of survey findings may be more conducive to meaningful analysis. This can be readily achieved by seeking responses to a properly designed questionnaire. In the present context, therefore, a questionnaire was designed with the object of soliciting responses from industry actors as well as legal personnel regarding the issue of CE between carriers in contemplation of encountering various legal implications. The study was conducted in Sri Lanka. 16 of the top 20 CSLs in the world operate regular services in the busiest commercial port in Sri Lanka, Colombo, primarily because of the strategic geographic location of port of Colombo in Sri Lanka [6]. Accordingly, researchers are confident that enough representation of shipping lines and their agents can be derived from the sample.

The responses of container carriers were obtained using a questionnaire. In the questionnaire survey, the respondents marked their preferences under wide scales of score ranging from -5 to +5 namely, "Extremely Disagree" to "Extremely Agree". Questionnaire was distributed to 110 shipping agents in Sri Lanka. Out of them, 31 respondents did not respond. However, the response rate (72%) was acceptable according to key informants given such industry norms as some shipping agents were not allowed to reveal any data due to

confidentiality nature. Questionnaire B was sent to 320 employees in cargo exporting companies out of which 264 respondents (82.5%) participated in the survey. Structural Equation Modelling and Stated Preference Method were mainly used in data analysis. In addition, interviews have been carried out with 10 shipping experts. There discussions were quite lengthy and highly informative. The intention was to analyze the responses and draw conclusions which could then be considered in light of any existing relevant legal regime concerning the subject. In the absence of such a regime, an attempt was made to propose a legal framework that would accommodate the propositions made in this paper from a commercial viewpoint. In addition, wherever necessary, a desk research was carried out to compare the information extracted through interviews.

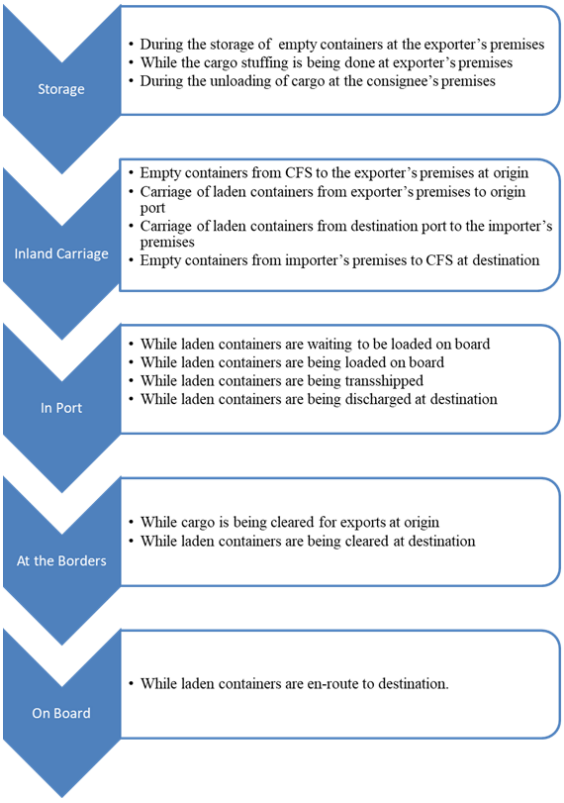


Fig. 4 The locations where the shipping lines may be exposed to legal implications

IV. Data Analysis and Discussions

The internal consistency of the variables can be determined through a reliability test. The survey questionnaire mainly consisted of Likert-type scale-based questions which is why a reliability test was conducted to determine each factor among categorized variables.

TABLE III
Reliability Statistics

Cronbach's Alpha	N of Items
0.850	18

If the internal consistency is high, those items can be used to create the variables. Based on the value, decisions are taken about the acceptability of the variables, and if Cronbach's alpha is less than 0.5 the results are unacceptable. As per above statistical output, internal consistency of the variables considered in this research are considered acceptable.

TABLE IV
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.787
Bartlett's Test of Sphericity	Approx. Chi-Square	2696.937
	df	153
	Sig.	0.000

The Cronbach's alpha value recorded in this research was 0.85; this is considered highly acceptable to proceed with further analysis. Next, the Kaiser-Meyer-Oklin (KMO) and Bartlett's test were exercized. Suitability of data for the KMO factor analysis can be measured by the measure of sampling adequacy. KMO denotes the sample size of the data. In this research, the value of KMO measure of sampling adequacy was recorded at 0.79, conforming to the recommended value standards. Total variance represents the total percentage of variance of components which is described by the variables.

TABLE V
Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	6.153	34.182	34.182
2	3.121	17.338	51.520
3	2.123	11.793	63.313
4	1.727	9.597	72.910
5	0.960	5.332	78.241
6	0.785	4.362	82.604
7	0.684	3.799	86.403
8	0.549	3.050	89.453
9	0.458	2.544	91.997
10	0.388	2.153	94.150
11	0.329	1.828	95.978
12	0.206	1.145	97.123
13	0.148	0.821	97.943
14	0.126	0.699	98.643
15	0.086	0.480	99.122
16	0.064	0.358	99.480
17	0.050	0.277	99.757
18	0.044	0.243	100.000
Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	6.153	34.182	34.182
2	3.121	17.338	51.520
3	2.123	11.793	63.313
4	1.727	9.597	72.910
Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	4.517	25.096	25.096
2	3.470	19.277	44.373
3	3.095	17.194	61.567
4	2.042	11.343	72.910

According to Table V which lists the 18 values associated with each linear factor before extraction, after extraction and after rotation, 18 factors within the data set have been identified. The extraction sums of the squared loading part show factors which met the criteria. The statistical tool extracts all factors with 18 values greater than 1. Altogether these four components explain the 73% variation of total variance. It was then decided to precede the study by realigning the four components by considering extraction sums of squared loading. The factor rotation has been completed according to the varimax rotation method to gain the meaningful factors. These variables were variances between -1 to +1. Furthermore, significance value should be greater than the 0.5. The purpose of factor rotation is to deduct the number of factors which ensures high loading. Factor loading of the five-factor model that offers varimax rotation is shown in Table VI.

According to Table VI, factor loadings for EXPCUS; PRTLDG; LDDONB; ONBDST; PRTDIS; and IMPCUS have higher loadings compared to other variables within component 1. Thus, it can be considered that these six variables are highly significant and more influential than other variables. Thus, component one can be formed as using these six variables, component two with four variables and so on. Accordingly, following equations can be developed.

Shipping Associate = *f* (EXPCUS, PRTLDG, LDDONB, ONBDST, PRTDIS, IMPCUS)

Warehousing Associate = *f* (CFSEWH, EWHSTF, IWHDIS, IWHCFS)

Flow creator = *f* (LGLOBL, OFFROR, EWHPRT, TRNSHP, PRTIWH)

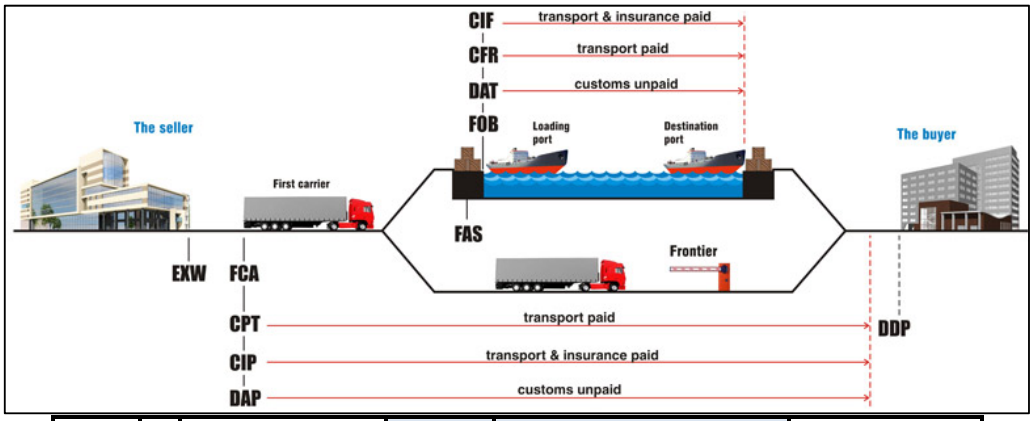
Trading outcome = *f* (OFFREE, EXPTWH, IMPTWH)

Fig. 5 illustrates the perceived impact versus the shipment process based on INCOTERMS. The Incoterms® rules provide rules and guidance to importers, exporters, lawyers, transporters, insurers and students of international trade [41]. The main features of the Incoterms® 2010 rules are illustrated in Fig. 5 [42], [41].

TABLE VI
ROTATED COMPONENT MATRIX

		Component			
		1	2	3	4
1	LGLOBL	0.152	0.296	0.493	-0.167
2	OFFROR	0.299	0.386	0.426	-0.013
3	OFFRFE	0.048	0.182	0.013	-0.280
4	CFSEWH	0.132	0.874	0.289	-0.040
5	EXPTWH	0.098	0.052	0.059	0.956
6	EWHSTF	0.124	0.904	0.137	-0.026
7	EWHPRT	-0.118	0.178	0.861	0.080
8	EXPCUS	0.869	0.191	-0.027	-0.119
9	PRTLDG	0.695	0.255	0.592	0.080
10	LDDONB	0.739	0.053	0.341	0.148
11	ONBDST	0.830	0.157	0.185	0.110
12	TRNSHP	0.519	0.091	0.638	0.079
13	PRTDIS	0.912	0.151	0.171	0.095
14	IMPCUS	0.855	0.140	0.046	-0.112
15	PRTIWH	-0.091	0.214	0.911	0.089
16	IMPTWH	0.084	0.083	0.043	0.956
17	IWHDIS	0.106	0.832	0.041	0.054
18	IWHCFS	0.114	0.813	0.222	-0.077

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in five iterations.



Component					
	1		EXPCUS	PRTLDG, LDDONB, ONBDST	PRTDIS, IMPCUS
	2	CFSEWH, EWHSTF			IWHDIS, IWHCFS
	3	LGLOBL, OFFROR	EWHPRT	TRNSHP	PRTIWH
	4	OFFREE, EXPTWH			IMPTWH

Fig. 5 An illustration of perceived impact versus shipment process

Considering the industry norms, practices and as per general understanding, component 1 can be named Shipping Associate. By exercising the same methodology, component 2, component 3, and component 4 are named Warehousing

Associate, Flow Creator, and Trading Outcome, respectively.

A. Shipping Associate

This component refers to potential legal implications under the following six scenarios; namely, while;

i. cargo is being cleared for exports by customs at origin port;
ii. laden containers are waiting to be loaded on board;
iii. laden containers are being loaded on board;
iv. laden containers are en-route to destination;
v. laden containers are being discharged at destination; and,
vi. laden containers are being cleared from customs and other border management agencies at destination.

B. Warehousing Associate

Four other scenarios that may lead to legal implications are identified under this component, viz.,

i. during inland carriage of empty containers from CFS to the respective exporter's premises at origin;
ii. while the cargo stuffing is being done at exporter's premises;
iii. during the unloading of cargo at the respective consignee's premises; and,
iv. during inland carriage of empty containers from importer's premises to CFS at destination.

C. Network Associate

Network Associate represents five important considerations in the shipping supply network, including the following:

i. there is no market practice to exchange containers between carriers;
ii. possible legal problems may arise by offering containers to other carriers;
iii. problems may occur during inland carriage of laden containers from exporter's premises to origin port;
iv. there could be legal concerns during inland carriage of laden containers from destination port to the respective importer's premises;
v. carriers perceive that there could be issues while laden containers are being transshipped in a third port.

D. Trading Associate

This component represents three important operational scenarios; namely,

i. possible legal problems that may arise by using containers belonging to other carriers;
ii. during the storage of empty containers at the respective exporter's premises; and,
iii. during the storage of laden containers at the respective importer's premises.

V. Conclusions

According to the above statistical analysis, it is concluded that shipping lines perceive exchanging containers as creating unwarranted legal complications originating under 18 scenarios during the process of a container shipment. The present research introduces four components namely, shipping associate; warehousing associate; network associate; and trading associate that represent all the 18 scenarios mentioned above. As shown in this work, shipping lines perceive legal threats from the deployment of other containers (or vice versa) from the point the cargo is cleared for export by customs at the port of origin. It is also believed that legal implications may occur once cargo is stuffed and the laden containers are waiting to be loaded on board; and/or are being discharged at destination; and/or are enrouted to destination; and finally, are being cleared from customs and other border enforcement agencies at destination. All these scenarios of legal implications are statistically explained under the caption "Shipping Associate". In the same manner, "warehousing associate" refers to legal implications that may occur during inland carriage of empty containers from CFS to the respective exporter's premises at origin as well as from importer's premises to CFS at destination. The analysis also considers the potential legal issues arising while the cargo stuffing is in process at the exporter's premises; during the unloading of cargo at the respective consignee's premises and during the inland carriage of empty containers. The Network Associate component is involved throughout the entire shipping supply network including the consideration of market practices pertaining to exchange of containers between carriers and possible legal problems that may arise by the offering of containers to other carriers.

The analysis then considers the scenarios of legal implications occurring during inland carriage of laden containers from exporter's premises to the port of origin, inland carriage of laden containers from the destination port to the respective importer's premises, and while laden containers are being transshipped in a third port. Finally, the Trading Associate component focuses on possible legal problems that may arise by using containers belonging to other carriers, during the storage of empty containers at the respective exporter's premises, and during the storage of laden containers at the respective importer's premises.

This paper examines the legal background to the concept of v between carriers. It may be vital to the task of evaluating the impact of legal implications of forming and operating a VCY and proposes recommendations to minimize the negative impact of perceived legal implications of VCY as a related and extended piece of research.

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